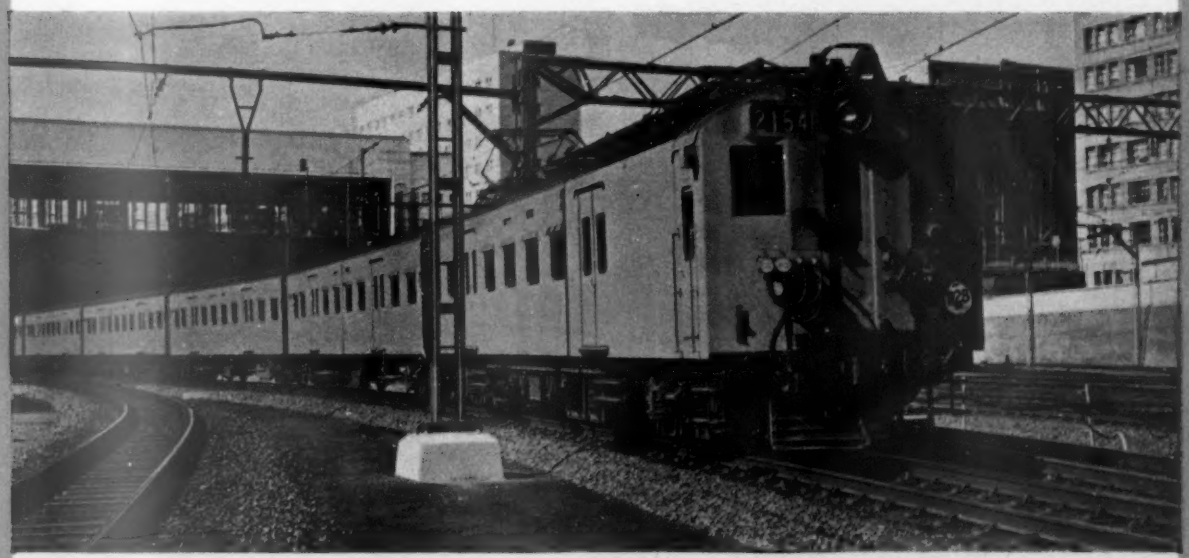
THE
RAILWAY GAZETTE

Price: Two Shillings | FRIDAY, JUNE 23, 1961 | Annually £5 by post

Latest AEI contract for South Africa



The latest AEI contract for multiple unit stock for South Africa is for the electrical equipment for 113 motor coaches, 60 driving trailers and 276 trailer coaches being built by the Union Carriage & Wagon Co., (Pty.) Ltd. The total equipments ordered from AEI for South African Railways now includes 350 motor coach equipments and 345 complete locomotives.

For further information apply to your local AEI Office or direct to AEI Traction Division, Trafford Park, Manchester 17

AEI **Associated Electrical Industries Ltd**

Traction Division

MANCHESTER AND LONDON

K/T 020

BUOYANT
Lace Web Seating

(By kind permission of the Pullman Car Company Ltd., B.T.C.).

for maximum comfort
THE LACE WEB SPRING CO. LTD.

SANDIACRE near NOTTINGHAM

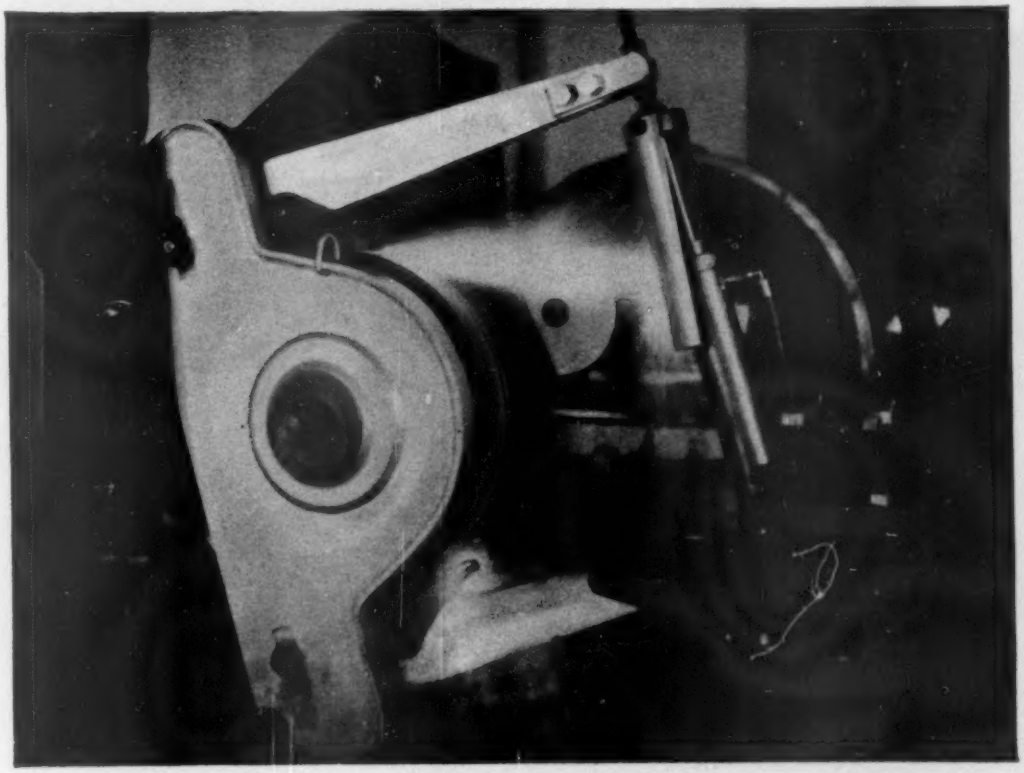
Phone: Sandiacre 2133-4-5

THIS ILLUSTRATION SHOWS BUOYANT LACE WEB SEATING IN PULLMAN CAR SECOND CLASS STOCK. MANUFACTURED FOR THE PULLMAN CAR COMPANY LTD., BY METROPOLITAN-CAMMELL CARRIAGE AND WAGON CO. LTD.

RAILWAY MATERIALS—wherever there are railways

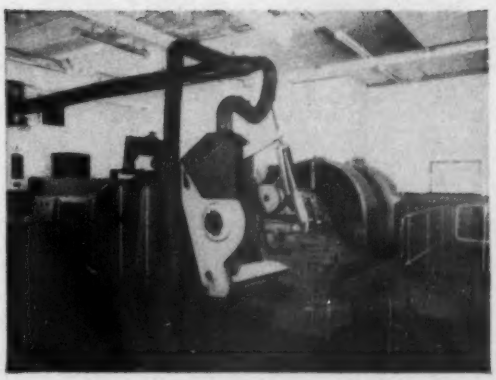
STEEL, PEECH & TOZER

A Branch of The United Steel Companies Limited **P.O. BOX 50, THE ICKLES, ROTHERHAM, ENGLAND**



Under modern operating conditions railway wheels have to withstand high temperatures, heavy loading and high levels of stress. The wheel testing machine illustrated is used to determine the best qualities of steel for wheels which have to withstand these conditions.

The colour picture illustrates a wheel testing machine braking a solid wheel from high speed.



THE UNITED STEEL COMPANIES LTD

SP222

JOHN BULL

CONVOLUTED HOSE

Stockinette reinforced or plain, John Bull convoluted hoses are made in natural or synthetic rubber to withstand high and low temperatures, oil and chemical attack and ageing. They are suitable for gases as well as liquids. Manufactured by the patented John Bull process, uniformity of wall thickness is retained throughout the convolutions. Air cleaner hoses are made to the same high standard.

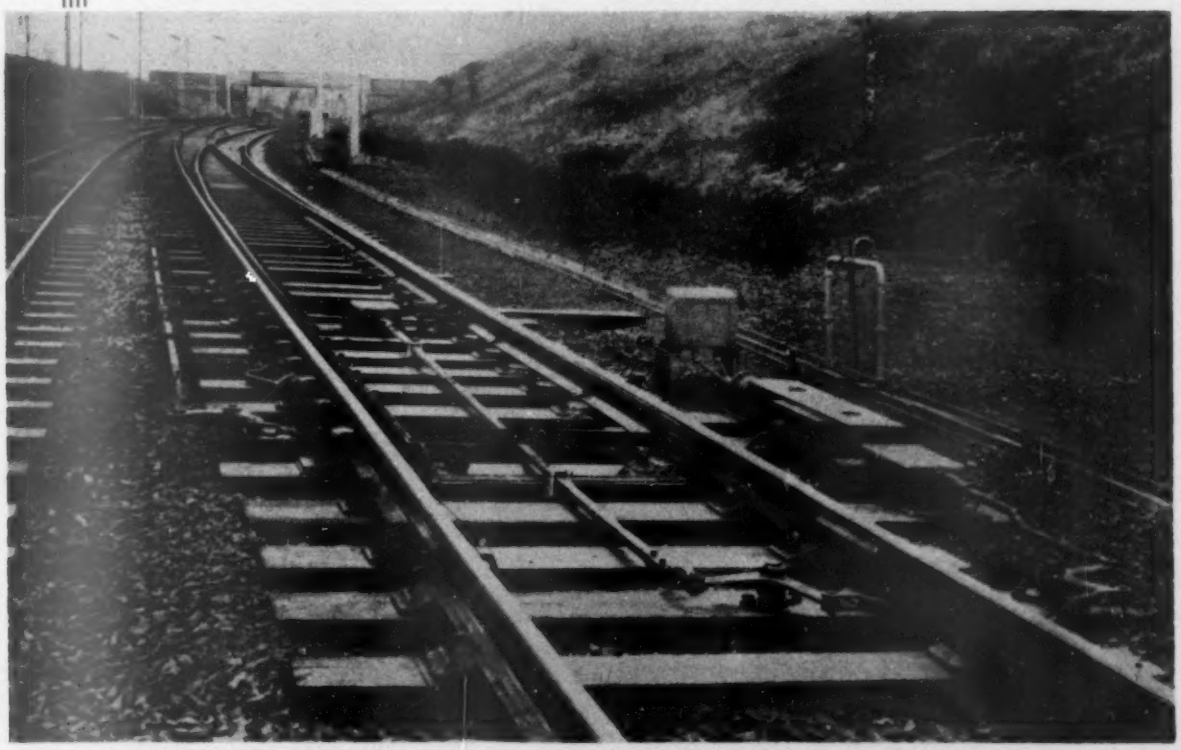
All rubber hose is available in standard 4 ft. lengths in a range of diameters. Specially fashioned hoses can be manufactured to your requirements.

Steam Heating, Vacuum and Air Brake hose is made to B.R. specification. In addition to hose, John Bull products include traction motor ventilating bellows, chair pads and all types of rubber moulding.

JOHN BULL RUBBER CO. LTD. (Mechanical Products Division) LEICESTER
TELEPHONE: 34531

Long Switches for High-Speed Turnouts (up to 90 m.p.h.)

60 ft. long 'G' switches with 24 slide chairs per switch.
Triple drive for ease of movement.
Double locked for Safety.
Operated by one electro-pneumatic point movement.



Installed at Weaver Junction, London Midland Region, British Railways

WESTINGHOUSE

BRITISH DESIGN AND MANUFACTURE

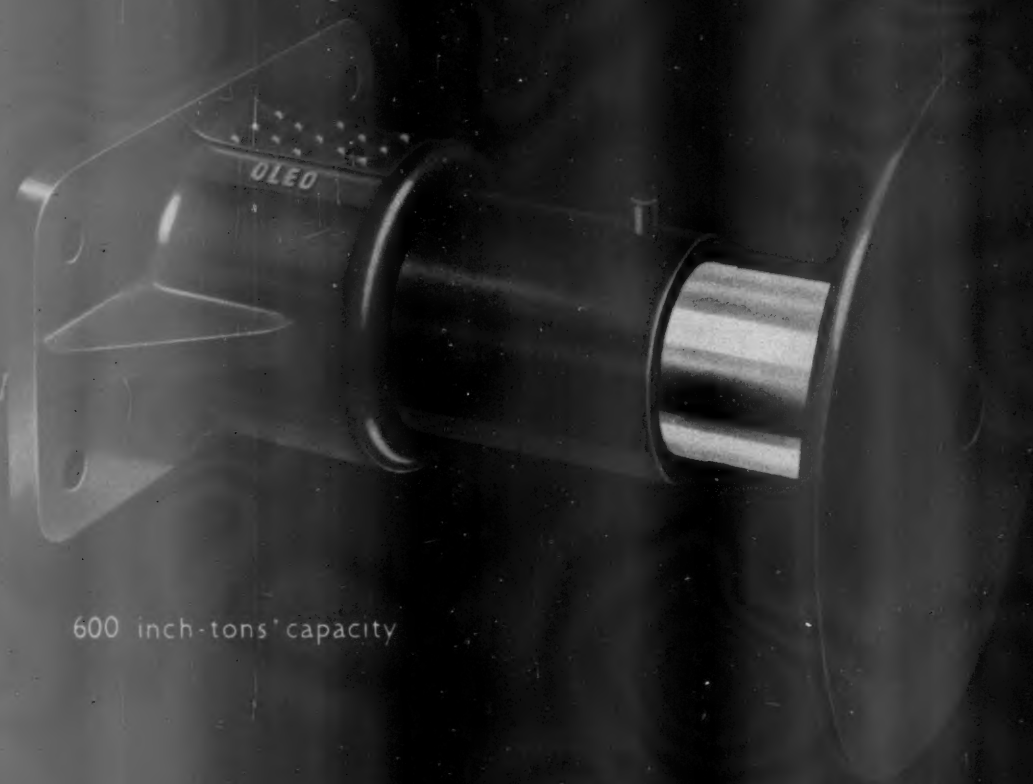
SIGNALLING for RAILWAY MODERNISATION

WESTINGHOUSE BRAKE AND SIGNAL CO. LTD., 82 York Way, King's Cross, London, N.1

Saxby & Farmer (India) Private Ltd., Calcutta. McKenzie & Holland (Australia) Pty., Ltd., Melbourne.
Westinghouse Brake & Signal Co., S.A. (Pty.) Ltd., Johannesburg. *Agents—Bellamy & Lambie, Johannesburg.*

A9

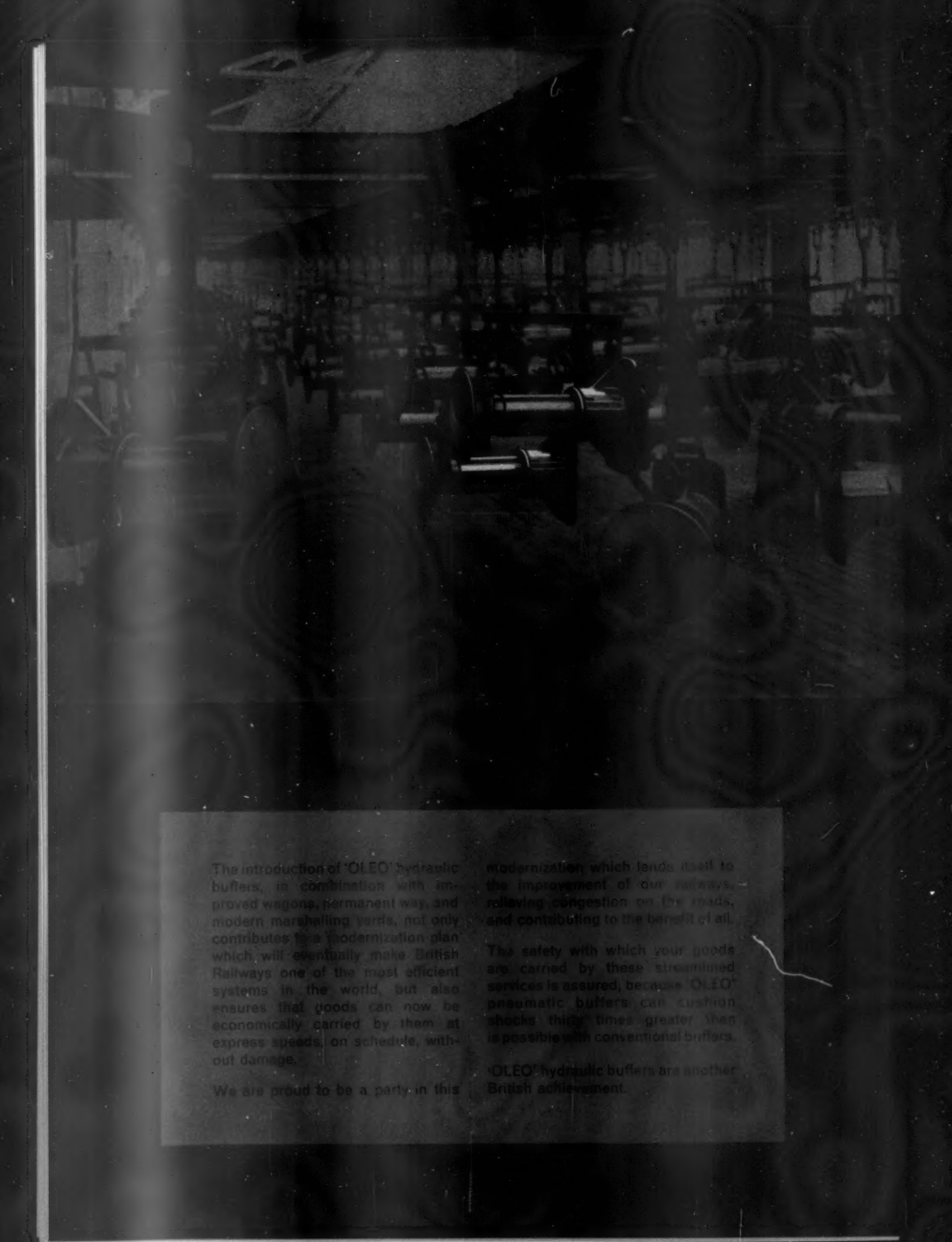
Dependable Hydraulic Buffers
Pioneered by Oleo



600 inch-tons' capacity

Oleo Pneumatics Ltd

KENILWORTH · ENGLAND



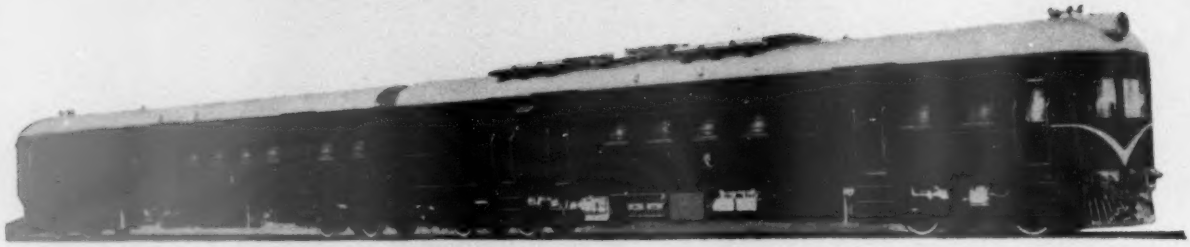
The introduction of 'OLEO' hydraulic buffers, in combination with improved wagons, permanent way, and modern marshalling yards, not only contributes to a modernization plan which will eventually make British Railways one of the most efficient systems in the world, but also ensures that goods can now be economically carried by them at express speeds, on schedule, without damage.

We are proud to be a party in this modernization which lends itself to the improvement of our railways, relieving congestion on the roads, and contributing to the benefit of all.

The safety with which your goods are carried by these streamlined services is assured, because 'OLEO' pneumatic buffers can cushion shocks thirty times greater than is possible with conventional buffers.

'OLEO' hydraulic buffers are another British achievement.

DREWRY RAIL CARS

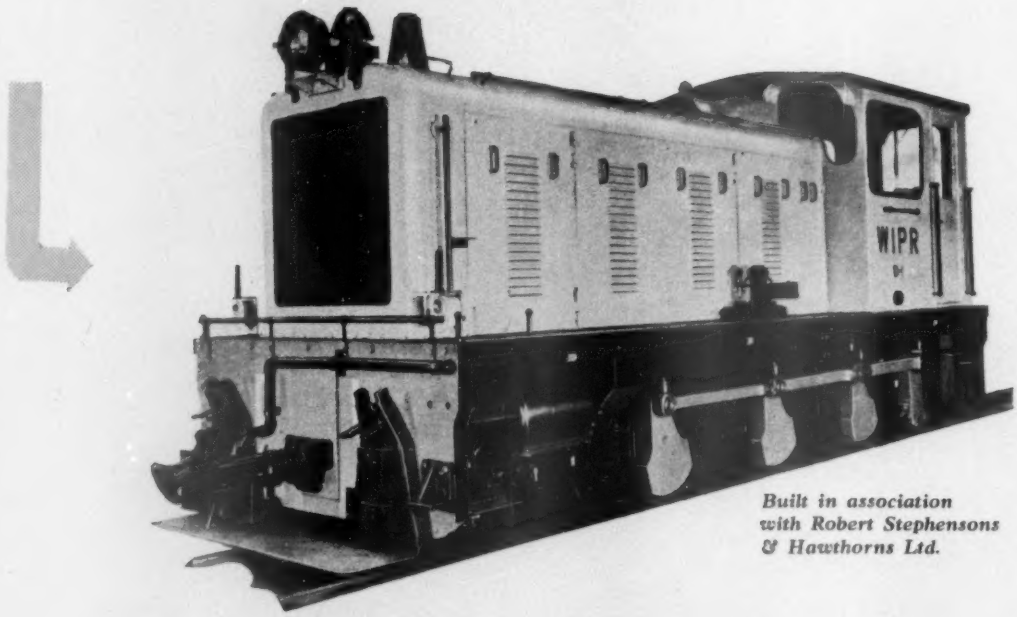


Built in association with The Birmingham Railway Carriage & Wagon Co. Ltd.

WITH MECHANICAL OR HYDRO-MECHANICAL TRANSMISSION

The upper illustration shows one of two Twin Car Units shipped this year to the Nigerian Railway Corporation, equipped with twin underfloor engines totalling 400 h.p. and multiple-speed epicyclic transmission with automatic control. The lower illustration is one of a number of 30-ton metre gauge Drewry locomotives recently shipped to Portuguese India, for freight and passenger duties.

AND LOCOMOTIVES



Built in association with Robert Stephensons & Hawthorns Ltd.

THE DREWRY CAR COMPANY LTD.

CITY WALL HOUSE, FINSBURY PAVEMENT, LONDON, E.C.2

TEL.: MONARCH 0671 GRAMS: INNEAL, PHONE, LONDON

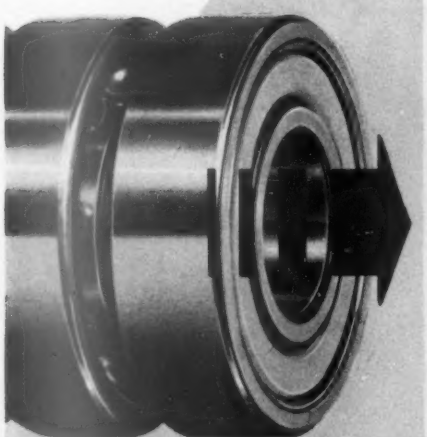
NEARLY 8,000 HOFFMANN BEARINGS

DOWN THE DRAIN...

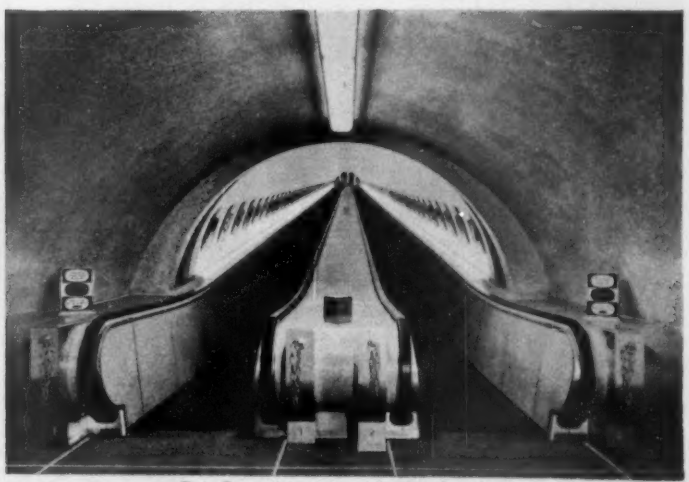
Londoners, journeying to the City call it "The Drain"—the foot-tunnel that leads from The Bank Underground station to the Waterloo and City line. But now tired or hurrying feet need no longer tread its length; they can step upon the Trav-o-lator and be carried all the way.

Manufactured by the Otis Elevator Company Limited, for British Railways, Southern Region, the Trav-o-lator is, in effect, a moving pavement some 313 feet long. It consists of 488 individual, but closely-linked platforms, each of which rides upon four wheels with two Hoffmann bearings fitted to each wheel.

There are two Trav-o-lators, one for up and the other for down travellers, and so we can say, with pleasure, that there are nearly 8,000 Hoffmann bearings down "The Drain"



Straightforward, easy-to-fit Hoffmann bearings with shields to retain lubricant, were specified for this job, to ensure dependability, efficiency and smoothness of movement, the prime features in applications of this nature.



Twin Trav-o-lators viewed from platform level

Photograph by kind permission of Otis Elevator Company Limited.

HOFFMANN

HOFFMANN

BALL AND ROLLER BEARINGS

THE HOFFMANN MANUFACTURING CO. LTD., CHELMSFORD, ESSEX.

TELEPHONE: CHELMSFORD 3151 TELEX NO: 1951.

AXLE BOXES — *any size*

from the SMALLEST . . .

. . . to the LARGEST . . .

There is no limit to the size of the axleboxes we can make. Illustrated are typical examples of the many types supplied for rolling stock and motive power requirements for railways and other industries in all parts of the world.

ROBERT HYDE CASTINGS

NORTH STAFFORD STEEL FOUNDRY • STOKE-ON-TRENT

Tel.: 44261-2

CLARENDON WORKS • CHESTERFIELD • *Tel.: 3181-2*

LONDON OFFICE: 52, GROSVENOR GARDENS • S.W.1 Tel.: SLOANE 9972

TWO NAMES ONE AIM

THE PLAN to install diesel locomotives throughout British Railways takes one more step forward with the liaison of two great names in the engineering world.

Seventy-six sets of engine transmission equipment, which include generators, traction motors and control equipment have been ordered from the Brush Electrical Engineering Co. Ltd. for British Railways Type 4 diesel electric locomotives. In conjunction with this, diesel engines of 2,500 h.p. will be supplied by Sulzer Bros. (London) Ltd. These are now being built in the workshops of Vickers-Armstrong (Engineers) Ltd. The knowledge and craftsmanship of these two organisations — Brush and Sulzer — are thus being combined to produce first class diesel electric locomotives in conjunction with British Railways.

BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED · LOUGHBOROUGH · ENGLAND

A member of the Hawker Siddeley Group

HITACHI

Costs go down
Efficiency up
with this light-weight Diesel Hydraulic Locomotive

This 1,100 PS *70-ton locomotive was developed by Hitachi to provide higher efficiency at lower operating and maintenance costs in main line service. Fitted with a compact, high-speed Hitachi-M.A.N. engine (Type L12V 18/21 m.A.) and a three-torque converter type hydraulic transmission (Hitachi LAZ 10R) with built-in reversing gear, delivering high tractive effort over the entire speed range.

Having been designed for metre-gauge and 3'6" gauge use, the mean axle load is a low 11.7 tons. Many advanced features are offered, and include power transmission system by thorough Cardan drive, ideal centering system for 3-axled bogie truck, indirect oil cooling system, resilient mounting for power plant, and various protective and alarm devices.

* engine output can be increased to 1,250 PS when the charging air intercooler is used.

Hitachi, Ltd.
Tokyo Japan

Cable Address: "HITACHY" TOKYO

STEEL AND THE RAILWAYS

The lifeline of the nation . . . vital to its economy . . . vital to its progress . . . vital in fact to its very existence . . . is the railway network. The key factor in its continued development and operation is steel. Here the Colvilles range of special steels has been developed to meet the needs of the nation today.

COLVILLES

FITNESS FOR PURPOSE STEELS

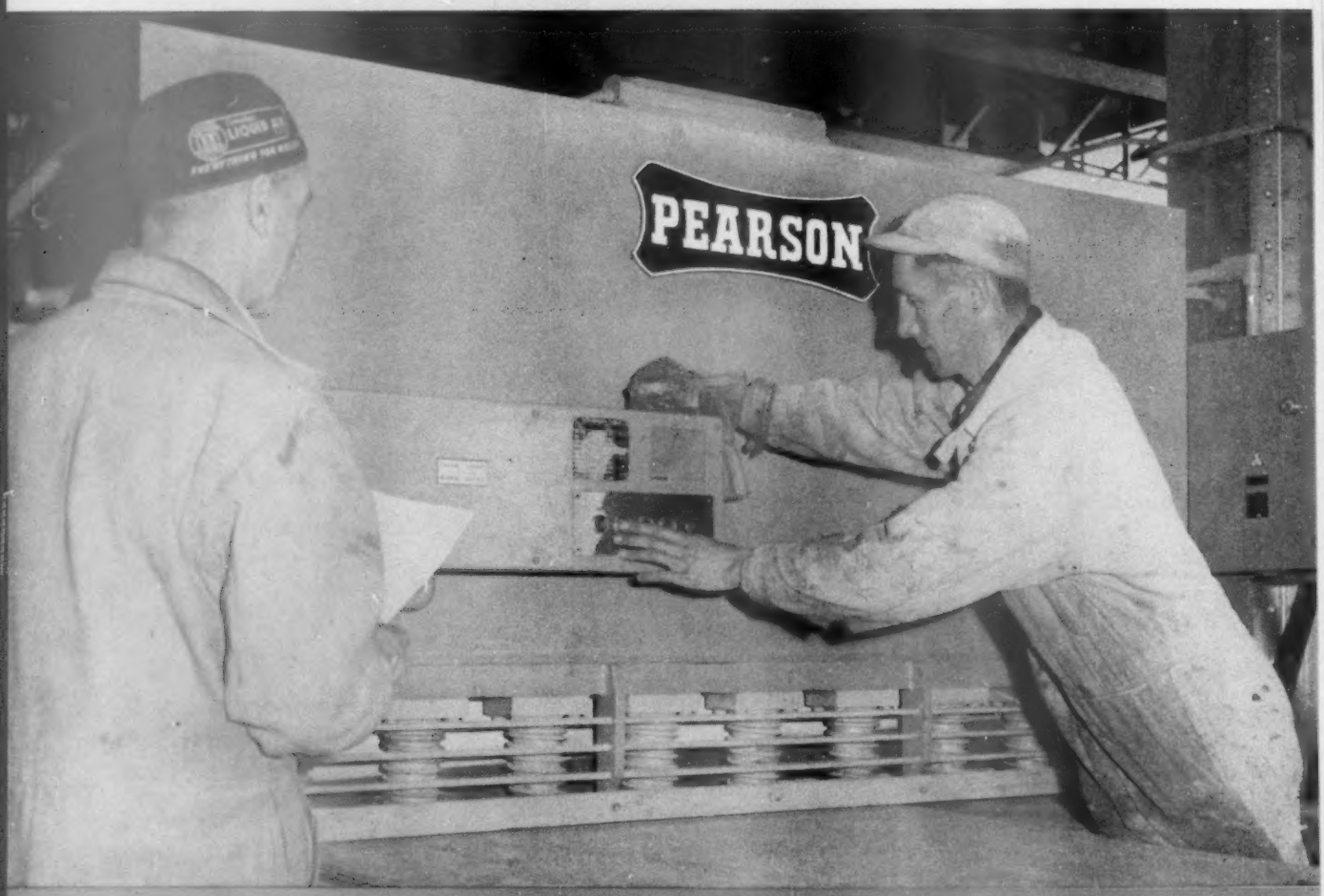
COLVILLES LIMITED 195 West George Street, Glasgow C.2.

from Cardiff to Capetown, Middlesborough to Melbourne, Warrington to Winnipeg

PEARSON

ELECTRO-HYDRAULIC PRESSES AND GUILLOTINES...

IN SERVICE ALL OVER THE WORLD



Guillotine Shears from ⅛" to 1" M.S. Capacity. Presses from 50 to 1200 tons.

PEARSON MACHINE TOOL CO. LTD.

WALKER · NEWCASTLE UPON TYNE 6 · Telephone: Wallsend 625101 (6 lines)

CANADIAN BRANCH: PEARSON MACHINE TOOL CO. LTD., 40 ADVANCE ROAD, TORONTO 19, ONT.

The illustration shows a Pearson Electro Hydraulic Guillotine Shear of 6'-0" × ½" M.S. Capacity installed at the works of Dominion Bridge Co., Regina, Saskatchewan.

'ALFLOC' ON THE FOOTPLATE

Like most of us, the 'Alfloc' man probably once wanted to be an engine-driver. And, though his one-time ambition may have eluded him, he plays a vital part in helping the engine-driver. For 30 years, the 'Alfloc' Water Treatment Service of Imperial Chemical Industries Ltd. has been building up an unparalleled volume of skill and experience in handling problems of railway water treatment. Today, the 'Alfloc' man is helping to keep engines—both steam and diesel—out of the time-consuming sheds, helping to avoid exasperating breakdowns, helping to eliminate all problems connected with water usage.

Maybe the 'Alfloc' man can't drive the engine—but he brings the scientific and technological resources of I.C.I. to bear on all water problems that arise in keeping the engines running.

'alfloc' ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED
'ALFLOC' WATER TREATMENT SERVICE,
4 CROMWELL PLACE, LONDON, S.W.7.

AL-43

BRITAIN

powered diesel railcars

BRITISH UNITED TRACTION LTD

REFLECTIVE FOR SAFETY

Lamigraph plus SCOTCHLITE BRAND REFLECTIVE SHEETING

DAYLIGHT EXPOSURE

NIGHT EXPOSURE

These two entirely unretouched illustrations show two standard 'Danger—Overhead Live Wire' notices as supplied to British Railways. That on the right of each photograph is in Lamigraph standard non-reflective material; that on the left in new Lamigraph *plus* Scotchlite. Comparison will show the enormous reflective power of Lamigraph *plus* Scotchlite at night. The lower photograph was taken by the light of a car's sidelights—the car being 26 feet from the notices.

Lamigraph *plus* Scotchlite is a new departure in the field of signmaking, and a major advance in safety promotion. The combination of the properties of both Lamigraph Phenolic Board with Scotchlite Brand Reflective Sheeting results in a major additional advantage — Lamigraph *plus* Scotchlite signs are *not* subject to corrosion and are non-conductive. Very large panel sizes are now available.

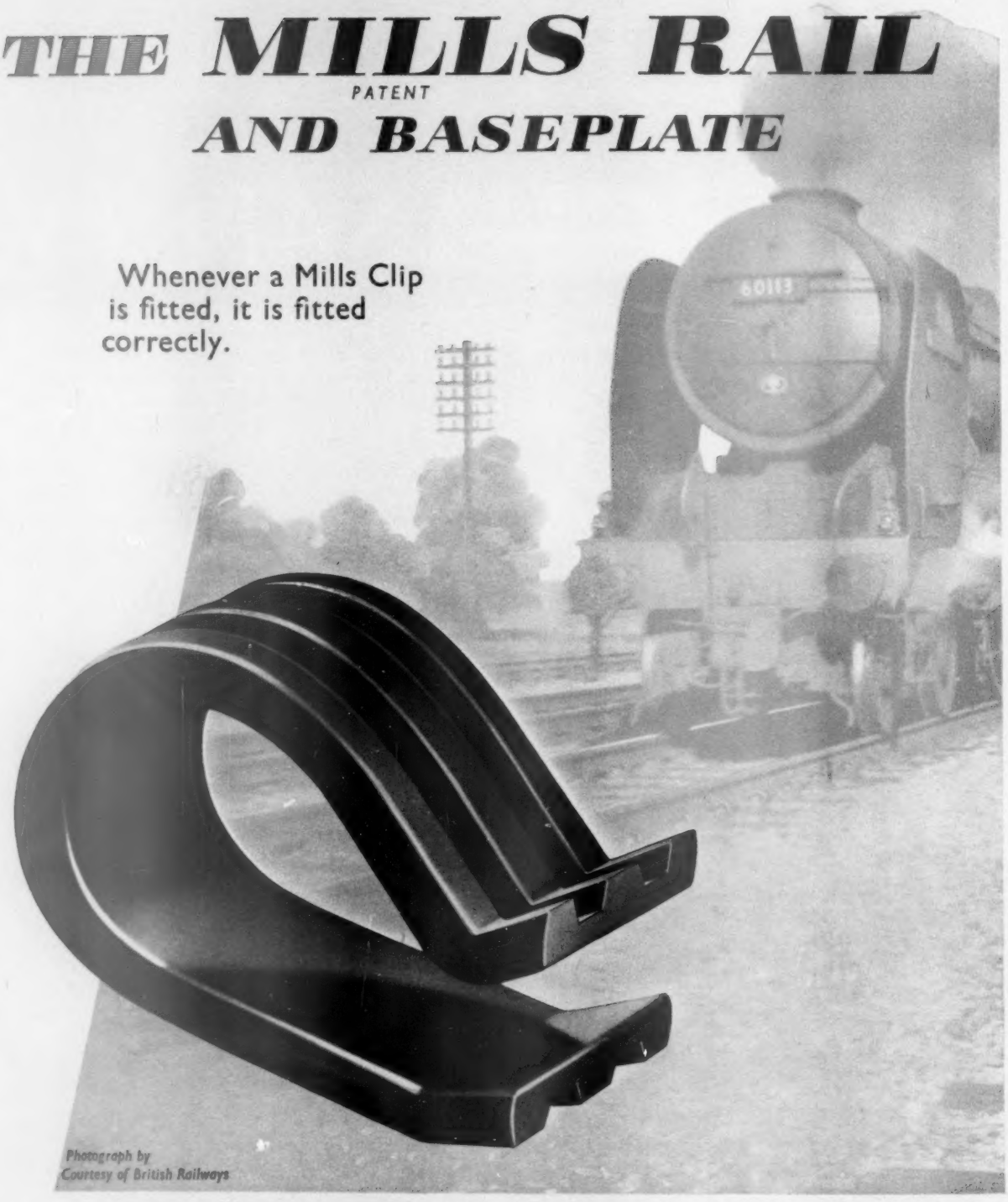
Safety is our business: if it's your business too, we'd like to hear from you.

Lamigraph LIMITED

273 OLD SHOREHAM ROAD · HOVE SUSSEX Telephones HOVE 70444 & 71464 Grams LAMIGRAPH HOVE

THE MILLS RAIL PATENT AND BASEPLATE

Whenever a Mills Clip is fitted, it is fitted correctly.



Photograph by Courtesy of British Railways

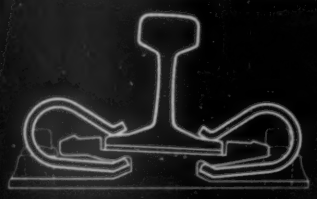
A MEMBER OF THE GKN GROUP OF COMPANIES

EXORS OF JAMES MILLS LTD

BREDBURY STEEL WORKS

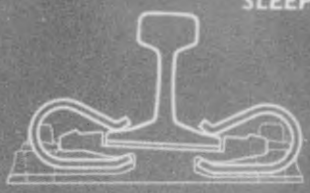
CLIP

FOR WOOD SLEEPERS



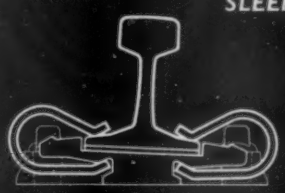
Four-hole baseplate with or without rubber rail pad.

FOR 'E' TYPE CONCRETE SLEEPERS



Two-hole baseplate, interchangeable with CSI Bullhead Chair.

FOR 'F' TYPE CONCRETE SLEEPERS



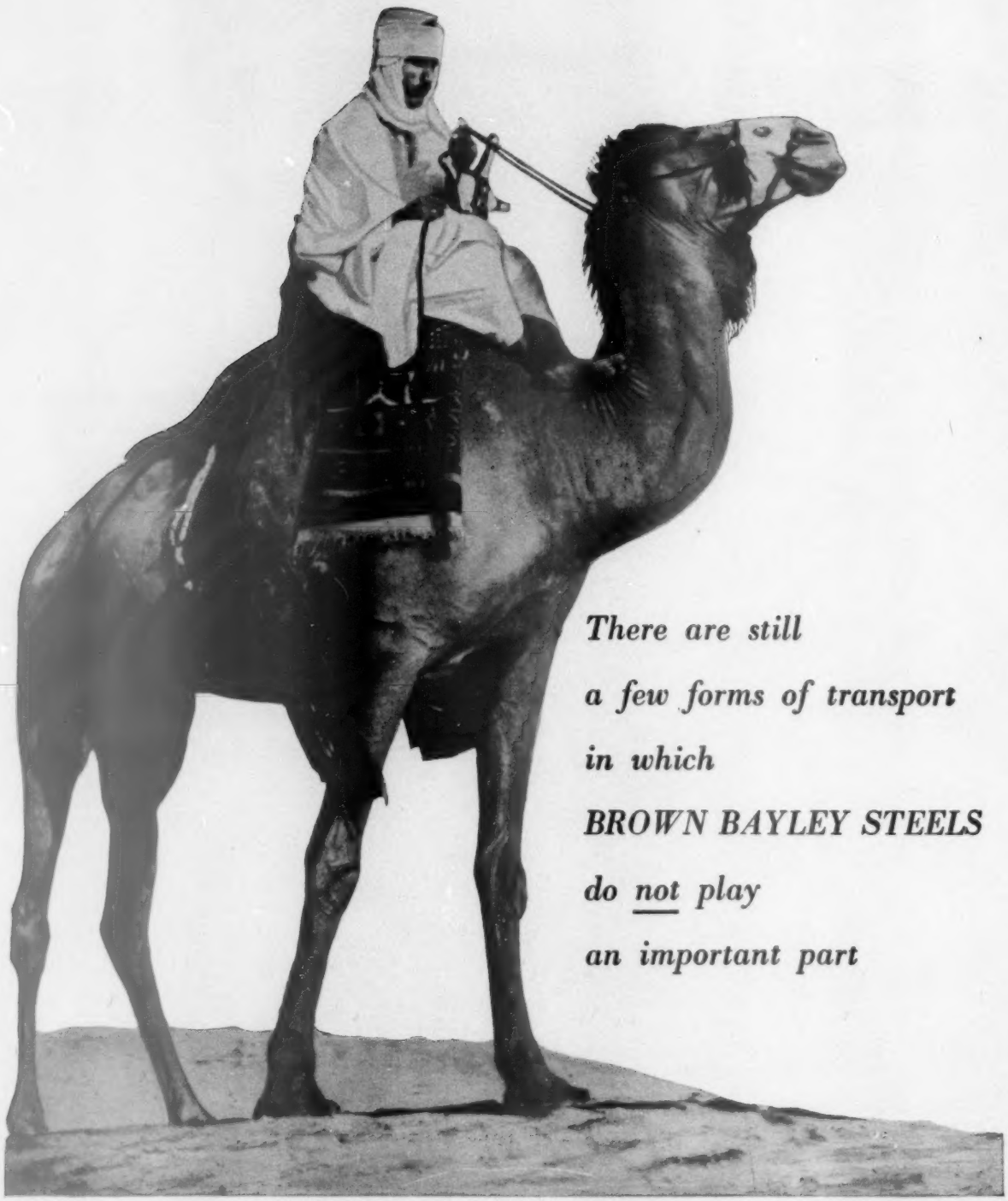
Small Area two-hole baseplate for main line use.

Every Mills Clip fitted applies a uniform load to the rail within a known range.

Very suitable for long welded rails and all heavy duty track

WOODLEY · NEAR STOCKPORT

Telephone: WOOdley 2231 (7 lines) 3431 (7 lines) Cables: Mills Woodley

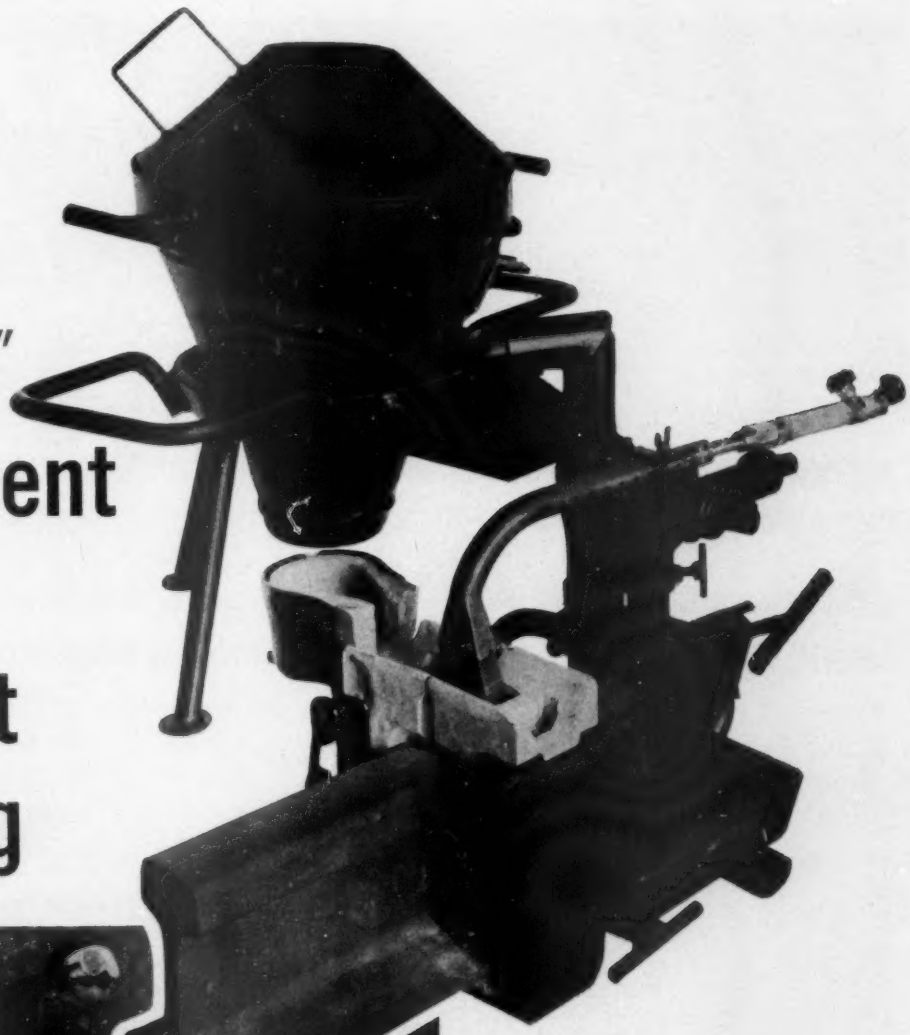


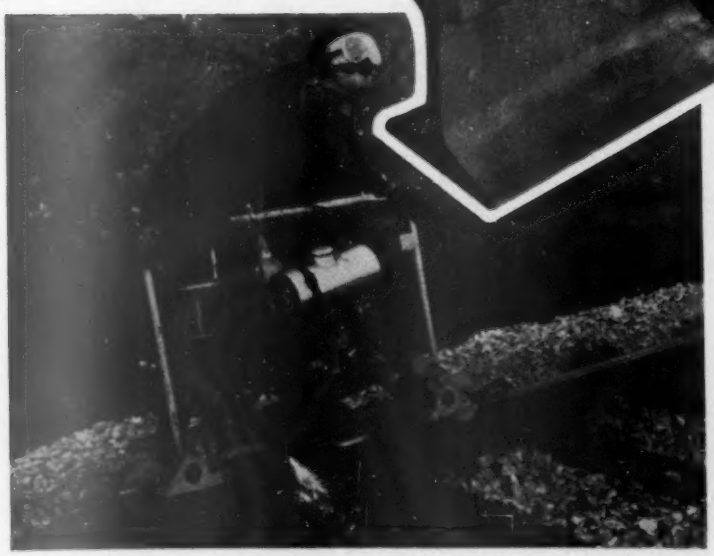
There are still
a few forms of transport
in which
BROWN BAYLEY STEELS
do not play
an important part

BROWN BAYLEY STEELS LIMITED · SHEFFIELD

BROWN BAYLEYS

This is the "QUICK" equipment for Thermit Welding





for really high-speed track welding . . .

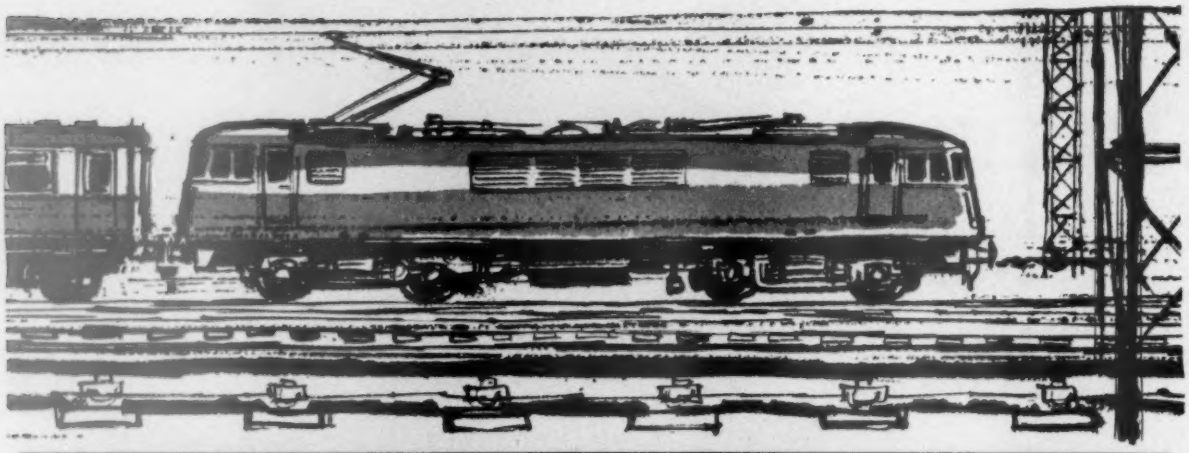
You're off to a good start with Thermit "Quick" Welding—the fastest method for rail joining. It takes, on the average, just 16 minutes after completion of rail alignment to weld and fettle a single rail—only 20 minutes when two rails are worked together.

"Quick" process equipment is simple and easy to transport and can be operated by local labour under trained supervision—more reasons for economies in costs and time.

The top photo shows the Thermit Welding "Quick" Equipment set up ready for the charge. The other picture illustrates the self-contained grinding unit being used on the Western Region of British Railways.

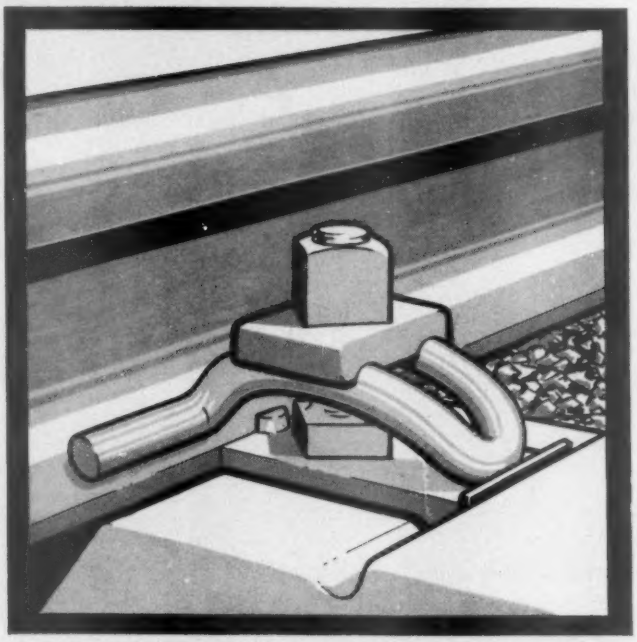
THERMIT WELDING [Gt. Britain] LTD RAINHAM, ESSEX *Telephone: RAINHAM 3322*

340



KEEP TRACK

Today's 100 m.p.h. traffic makes big demands on the track. To help cope with this problem, Bayliss, Jones & Bayliss have developed resilient rail fastenings for use with concrete sleepers and long welded rails. Approved by the British Transport Commission, these tough spring steel fastenings are the latest additions to the BJB range, which still includes, of course, many traditional types of fastening.



BAYLISS, JONES & BAYLISS LIMITED

Head Office: Victoria Works, Wolverhampton. Tel: Wolverhampton 20441
London Office: GKN House, 22 Kingsway, London, W.C.2. Tel: CHA 1616

BJB

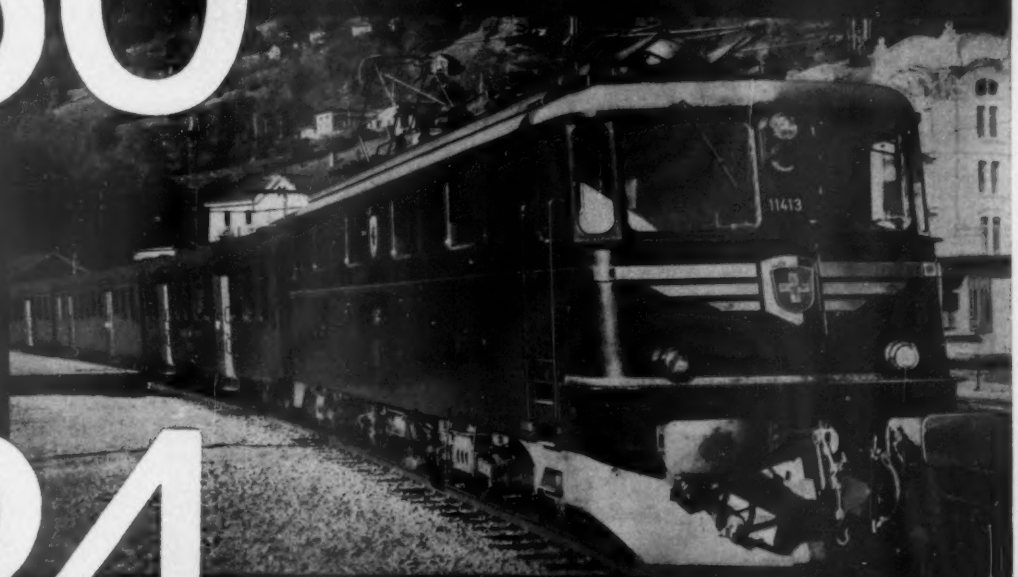
GKN

SLM

90 years experience in design and manufacture of locomotives and railcars!

50

of these 6000 HP Co-Co type locomotives are giving excellent service on the Gothard and the Simplon lines of the Swiss Federal Railways.

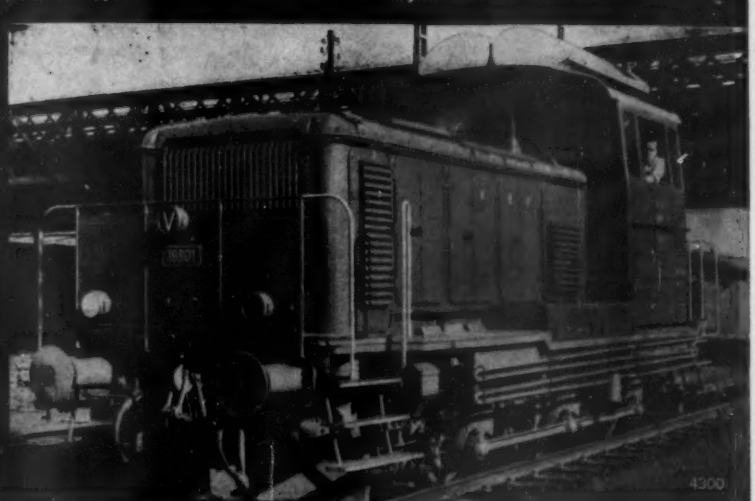


24

To meet traction requirements due to increasing traffic 24 more of these powerful and reliable engines have been ordered lately.

35

A further contract for the supply of 35 Diesel-electric locomotives, 600 HP each, fitted with SLM traction Diesel engines has also been placed by the Swiss Federal Railways.



Swiss
Locomotive and Machine Works
Winterthur

There's something special about this tool...

A Hicycle grinder wire brushing bellows at the works of Munrow & Miller Ltd. Edinburgh.

Hicycle tools are of special interest to you

Here's why

- **INCREASED PRODUCTION** A constant speed is maintained irrespective of load.
- **REDUCED WEIGHT** High sustained motor speed gives increased power to weight ratio, and so makes for effortless operation.
- **LESS MAINTENANCE** There are no commutators, brushes or brush gear to maintain, and the squirrel cage rotor cannot burn out.
- **GREATER ECONOMY** A Hicycle tool uses only a fraction of the power of a comparable compressed air tool.
- **MORE SAFETY** The voltage to earth is only 72 volts—safer than tools operating on the usual 200/250 volts.

It's a worker that never flags . . . . it maintains a constant grinding speed, whatever the load. This means far less operator fatigue and much more output per shift—often as much as 50% extra—compared to conventional power tools. Hicycle electric tools are available for most heavy-duty rotary operations, and are hard at work in virtually every industry. The Hicycle catalogue will be gladly sent on request.

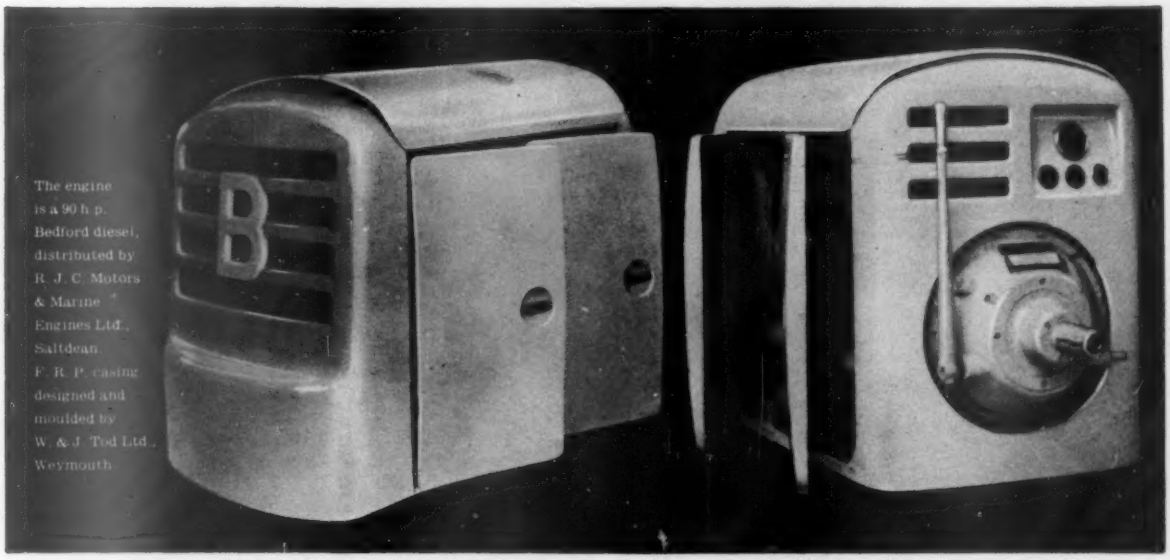
Hicycle
electric production tools by
CONSOLIDATED PNEUMATIC

For a better finish —faster!

CONSOLIDATED PNEUMATIC TOOL COMPANY LIMITED
DAWES ROAD · LONDON · S.W.6

"So pleased with the results and appearance that it was immediately ordered into production"

Extract from a report on this engine casing in Fibreglass Reinforced Plastics.



The engine is a 90 h.p. Bedford diesel, distributed by R. J. C. Motors & Marine Engines Ltd., Saltdean. F. R. P. casing designed and moulded by W. & J. Tod Ltd., Weymouth.

Engine casings were needed. The alternatives: moulding in F.R.P. or shaping in metal. The choice: F.R.P. This is why.

F.R.P. is light yet strong; it can, as in this case, be self-coloured, needing no painting or maintenance; it is unaffected by exposure to the weather and does not drum; it can be moulded easily and styled attractively. Finally, F.R.P. is highly resistant to most forms of corrosion—including the sulphur fumes given off by diesel fuel.

Would these advantages apply in *your* case, for *your* product? The answer may well be 'yes'; but ask us and we will tell you—without obligation and without bias.

FIBREGLASS TRADE MARK **the backbone of Reinforced Plastics**

Our advisory service is expert, confidential and free

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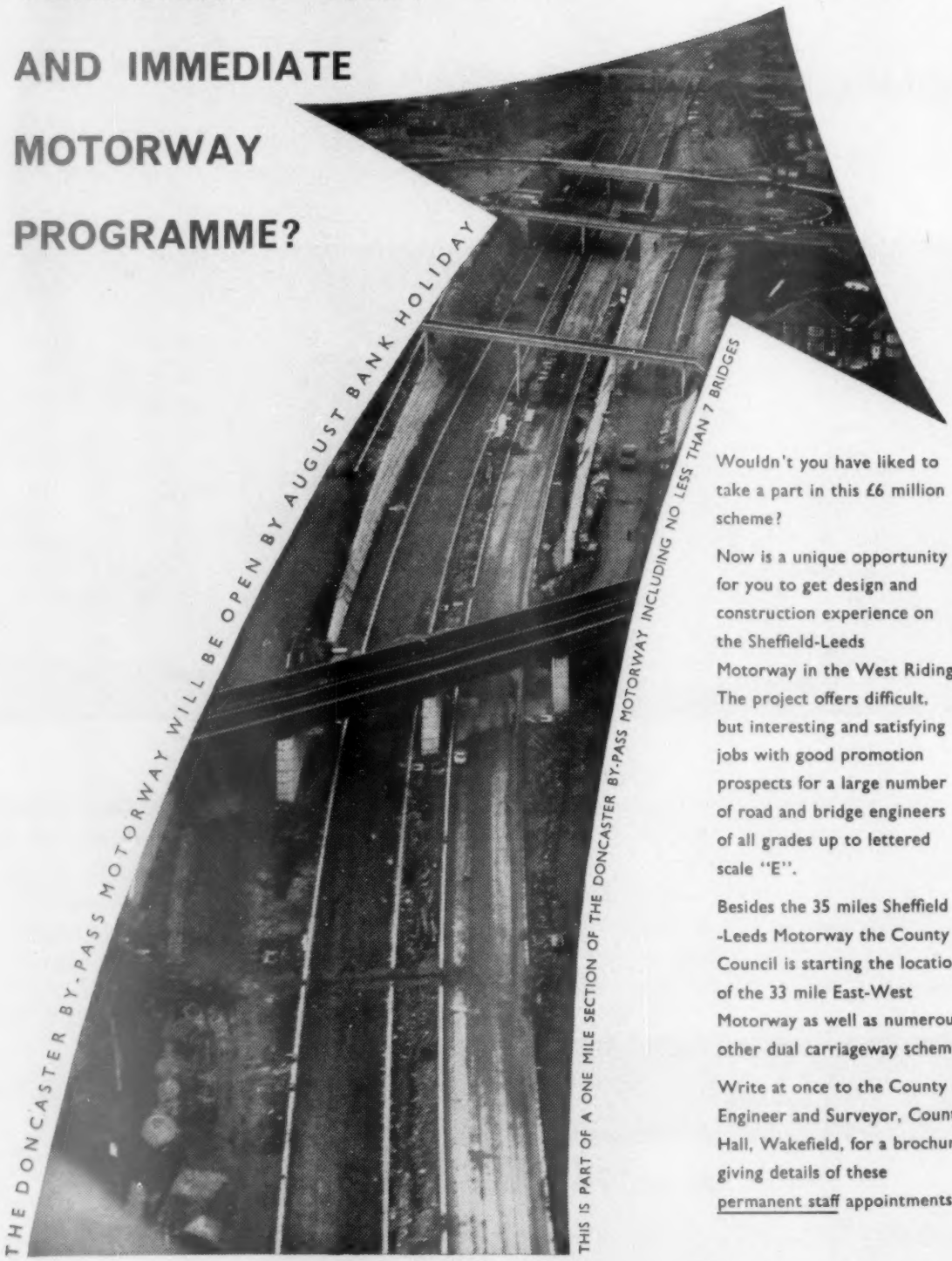
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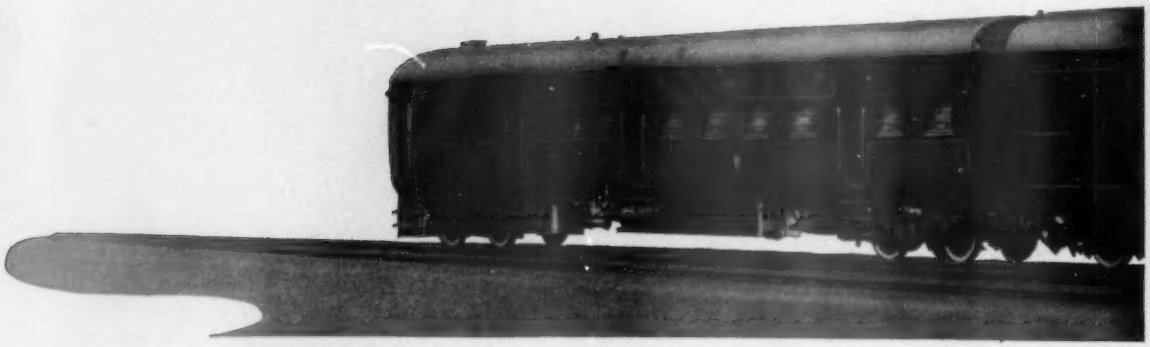

The Nigerian Railway Corporation have recently put into service two of these Twin Unit Diesel Railcars, supplied by the Drewry Car Co. Ltd., and built by Birmingham Railway Carriage & Wagon Co. Ltd. Each unit is fitted with Metcalfe-Oerlikon Patent Safety & Vigilance Control Equipment.

ANOTHER INSTALLATION OF THE

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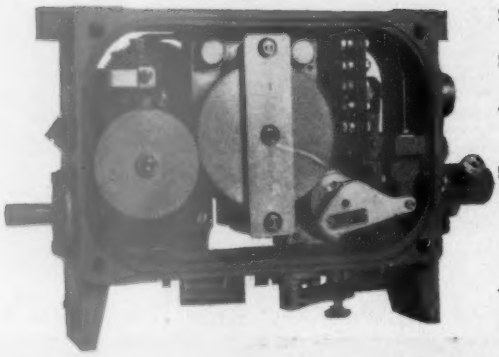

View of the safety side of the apparatus with the covers removed.

1 Normal Deadman's pedal.
2 Encased pedal for instep.
3 Sewing machine type pedal.
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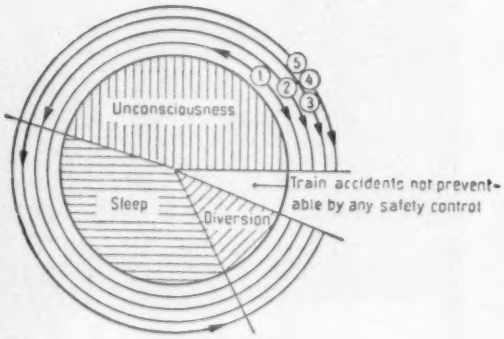
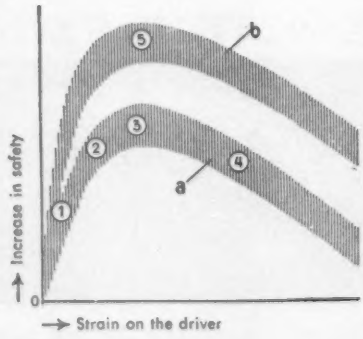


a Range of existing safety controls with pedals.
b Range of the Metcalfe–Oerlikon safety control.
1-5 Various pedal arrangements as fig. 1.

THESE CHARTS ILLUSTRATE THE SUPERIOR CONDITIONS AND RANGE OF SAFETY OBTAINED FROM THE SAFETY AND VIGILANCE CONTROL SYSTEM.



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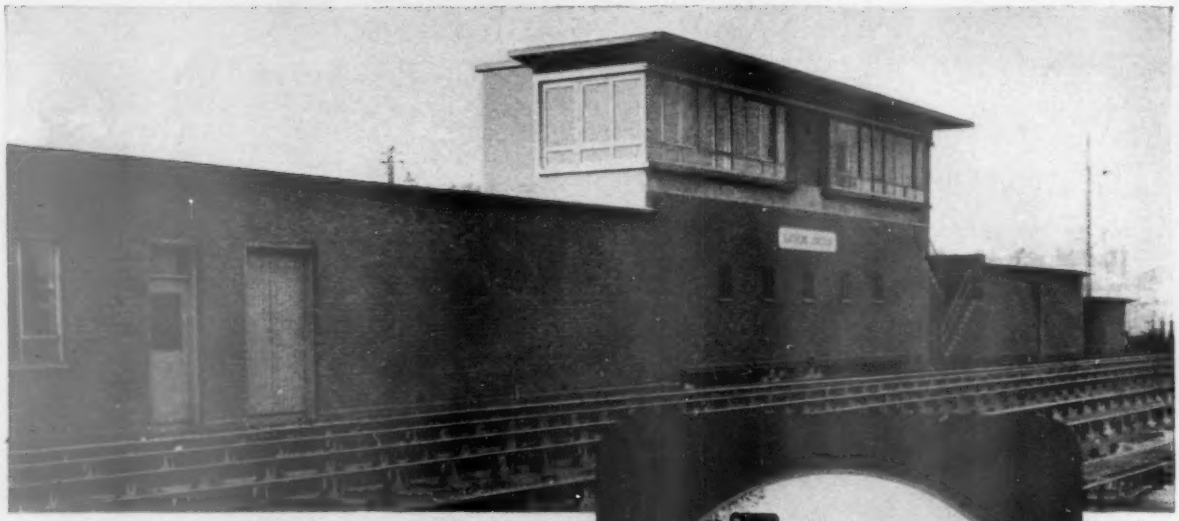

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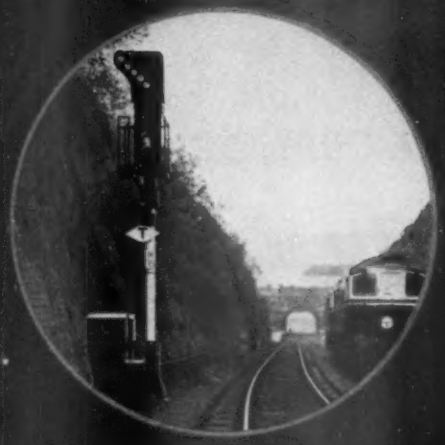

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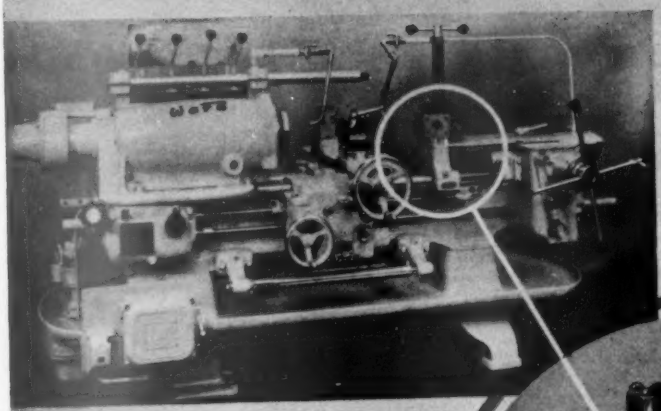

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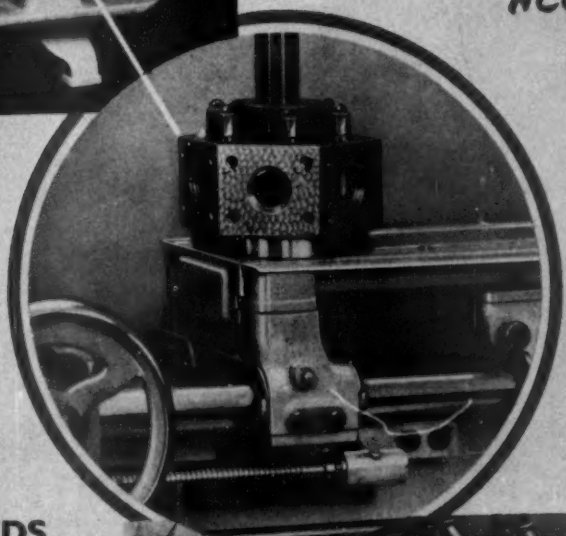

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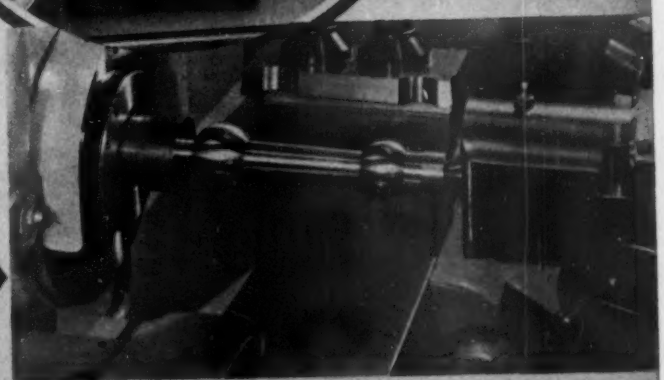

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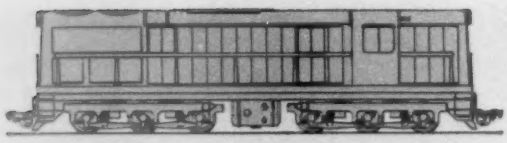

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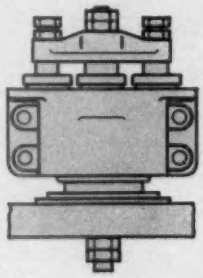

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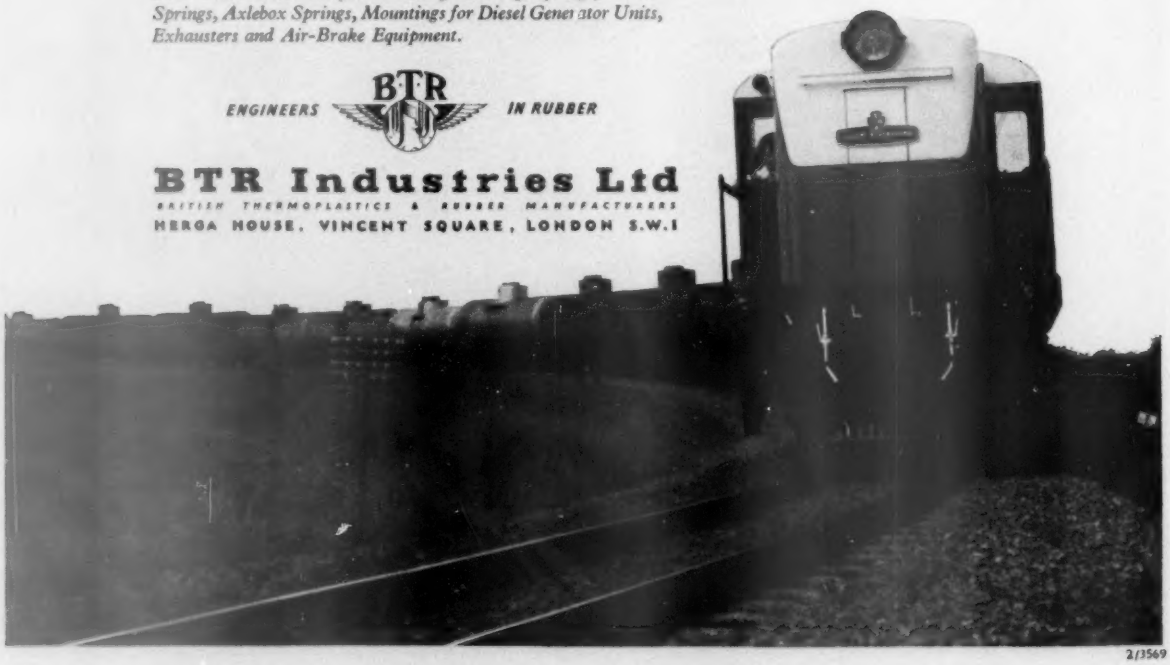

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A journal of Management, Engineering and Operation

VOL 114 FRIDAY JUNE 23 1961 No. 25

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Too little and too late

AFTER some six months since application was made, the Transport Tribunal has announced its decision on new fares for British Railways and the London Transport Executive. As a result, most bus and train fares in the London area will be increased by 1d. on July 30, and fares on British Railways' trains outside London will be increased by ¼d. a mile from September 1. The Tribunal has refused the British Transport Commission a 20 per cent margin over the existing maximum cost of season tickets on British Railways outside London, which would have permitted fixing costs according to need. It has allowed instead a 5 per cent increase now, which brings them up to London Transport's cost level and a further 5 per cent after January 1 next year. Since the application was made there has been a considerable increase in railway costs, and on the labour side alone claims have been put in for advances in wages as well as for shorter hours of work. The yield of the advances in fares just sanctioned has been estimated at about £8 million a year and will go but little way towards meeting the financial needs of the operators. On the other hand, it is probable that this decision of the Rates Tribunal will be the last of its kind, for it was made clear in the White Paper on the reorganisation of nationalised transport in December that the Government held the view that present restrictions on the ability of the railways to adjust quickly and adequately their charges and fares were no longer justified, and Dr. Richard Beeching, the Chairman of the British Transport Commission, has stated he is looking forward to fewer restrictions on railway charges and greater flexibility in their fixation.

Fares and general prices

THE announcement relating to the fares increases has led to the usual flood of public protest based on ignorance of the true cost of present-day travel in relation to the general prosperity of the country and the overall rise in prices. Leaving aside the pertinent matter of the effect of these on the purchasing power and labour market of the railways, it is clear from a properly-based study of the relevant figures that railway charges have lagged very greatly behind the general level of costs in the country. The following table contains cost of living indexes converted by computer from the 1938 London & Cambridge index of total retail prices in terms of 1948 to 1960. The comparative percentages are shown for average receipts per passenger-mile, a much more reasonable basis for discussion than others which have been more widely used.

Year	Cost of living index	Average receipts per passenger-mile
1948	100	100
1949	103	93
1950	106	91
1951	116	89
1952	126	93
1953	130	96
1954	133	96
1955	138	100
1956	145	104
1957	150	106
1958	155	106
1959	156	108
1960	158	120

Letting the public know

FROM the above table it is apparent that, quite apart from now being extremely low in relation to the cost of living index, average receipts per passenger-mile fell steadily below 100 for three years in succession and thereafter remained under 100 during a further three years. In our view, not sufficient is made of this point by the Commission when explaining the situation to the public. Here is a matter which should receive new consideration by the Public Relations Department. It is difficult to understand why the railways alone should arouse such public opposition to their endeavour to bring their prices in line with their costs. In our letters section this week, a correspondent suggests that more use might be made of railway posters for propaganda purposes. It is true that, of the many railway posters displayed, few present themselves immediately to mind in this context. Examples are the Southern

Region's claim that "It's quicker to travel by rail" and the Commission's warning to children on the dangers of electrified lines. A poster incorporating a similar table to that given in this editorial might prove equally effective.

Trade opportunities in W. Germany

SOME interesting details of market openings in West Germany for British exporters are given in the second report of the Export Council for Europe now available from the Council (price 5s.). Sir William McFadzean, the Chairman, states that the German market is wide open to British exporters of a wide range of products. British exports to this market have trebled since 1955 and doubled since 1958; including re-exports, they are now about £190 million a year. This is less than 5 per cent. of Germany's imports, and the eight-man mission which has drawn up the report is convinced that these figures could and should be substantially increased. Among the products listed as providing export opportunities are machine tools, factory trucks, scientific and measuring instruments, earth-moving equipment and iron and steel goods. Parts of locomotives and rolling-stock imported into Germany last year rose by 44 per cent; those from the United Kingdom were up by 10 per cent, representing 23·7 per cent of total imports of this kind.

Prices in the electrical industry

A WARNING that the electrical manufacturing industry required adequate profit margins if it was to continue to have the proper rate of capital expenditure, research and commercial development was given by Mr. Stanley F. Steward, Director of the British Electrical & Allied Manufacturers' Association at the British Electrical Power Convention at Eastbourne last week. Mr. Steward pointed out that electrical manufacturing was a leading scientific "growth" industry. It employed more than one-fifth of the scientists and trained engineers in all manufacturing industry, and its expenditure of £65 million a year on research was ahead of most other industries. This expenditure and the large increase in capital investment in recent years was essential to maintain a technical lead in world markets, but the result had been to reduce the return on capital. Mr. Steward suggested a ten-year plan for the whole industry prepared by means of a thorough, joint study by the supply and manufacturing sides and reviewed regularly in the light of technical progress.

"Golden Arrow" motive power

SINCE its inception 32 years ago the "Golden Arrow" has, the war years excepted, been hauled by steam locomotives. As recorded on page 628, electric locomotives of 2,400 h.p. were substituted on June 12. These locomotives, shedded at Stewart's Lane, carry the familiar gold metallic head board and the Union Jack and Tricolor at the front, and the practice of having golden arrows on the side of the locomotive is continued. As mentioned in the article, to which reference has been made, electrification has been introduced one year ahead of the original programme, but, as other work is not yet complete, the substitution of electric traction for steam has been a straightforward changeover, unaccompanied by any alterations in timing. The full benefits cannot be derived until June, 1962, when the whole of the Phase 2 work, will be completed.

Setback to U.S.A. railways

AT March 31, operating revenues of American railways in respect of the first quarter of 1961 were $283 million less than in 1960. Freight receipts were down $264 million, nearly 13 per cent. Passenger receipts were $5·6 million lower, almost 4 per cent, and parcels receipts dropped by $4 million, or 18 per cent. Operating expenses were reduced by $132 million, about 7 per cent, but the operating ratio rose from 79·3 per cent to 83·7. Earnings, before charges, of $23·2 million were down $124 million, no less than 84 per cent. The number of railways in deficit at the end of the quarter was 35 compared with 20 a year earlier. The main seat of trouble was the Eastern District, where the New York Central was $15·5 million on the wrong side of the account, while the Pennsylvania was $13·4 million out and the Baltimore & Ohio $8·7 million. In the Western District the Burlington, Rock Island, & Western Pacific had a moderate rise in earnings, as had the Illinois Central and the Gulf, Mobile & Ohio in the Southern Region. All these railways kept their operating ratios below the critical point of 83 per cent. The Chesapeake & Ohio failed to do so and, though it cut expenses 6 per cent, lost 44 per cent of its 1960 earnings. The recession in heavy industries also affected the Norfolk & Western, but it reduced expenses 12 per cent, operated at the low ratio of 60 per cent and, despite a fall of 16 per cent in earnings, its return of $13·2 million was the highest for any railway. That was a remarkable feat for a railway working only 2,747 route-miles.

Machine tool research

A GOOD indication of progressive attitude being adopted by the British Machine Tool Industry was given this week by the opening on June 19 of premises for applied research at the head works of Alfred Herbert Limited, Coventry. The official opening of the building was performed by the Rt. Hon. Reginald Maudling, M.P., President of the Board of Trade. Basic research and product development has been an important part of the company's policy for over 70 years, and the centre will provide increased facilities for the team continuously engaged on this work. While facilities cover all requirements for the building and development of prototype machine tools, an important section of the research department programme is devoted to investigations of the wider aspects of economical engineering production as a whole. A typical instance of this is the rapidly increasing use of tape and punched card programme and positioning control methods. This technique has effected considerable reductions in machining and setting times, and in the use of jigs.

Type 3 diesel-electric locomotives

THE first of a total of 79 Type 3 main-line diesel-electric locomotives, ordered by the British Transport Commission from the English Electric Co. Ltd., is complete. Designed and built by English Electric in conjunction with its associate, Vulcan Foundry Limited, these locomotives are intended primarily for mixed-traffic working on the Eastern and North Eastern Regions of British Railways. They are also suitable for working high-speed passenger trains, with their maximum speed of 90 m.p.h. Train-heating equipment is installed. These units may be operated in multiples with similar locomotives, or with Types 1, 2 and 4 locomotives produced by the same builders. They can also be coupled with the majority of Types 1, 2, 3 and 4 locomotives built by other manufacturers. The wheel arrangement is Co-Co, the weight in working order 103 tons, and the horsepower 1,750. The maximum tractive effort is 55,500 lb., and the continuous rated tractive effort 35,000 lb. at 13·6 m.p.h. The minimum curve which can be negotiated is one of four chains radius.

Electric multiple-unit failures

BRIGADIER LANGLEY'S second interim report on the failures in British Railways' multiple-unit electric stock deals mainly with the Eastern Region. Yet, as the summary published on a later page shows, this report stems from the Glasgow failures: for Brigadier Langley rightly decided to extend his inquiry to cover the whole field. On balance, he strikes a re-assuring note. His recommended improvements to the Glasgow

system are well in hand, and the electric trains should begin running again before the end of this summer. The Eastern Region failures have been traced to a succession of troubles, of which the root causes are now known. Consequent modifications have been made, and further tests are still needed, but fundamentally the equipment is sound. The real problem arises out of the fact that these systems operate on dual high voltages—25 and 6·25 kV. It is extremely probable that, within a space of months, they will be cured. Then Britain will have an electric suburban system, which will be both a pioneer and an example to the whole world.

Track surfacing by welding

BRITISH Railways are building up worn surfaces on switch and crossing rails on about 25,000 crossings annually by the use of oxy-acetylene welding. On this and other permanent way repair work 250 welders are permanently employed on 50,510 miles of track. These figures are given in the quarterly technical bulletin issued by the British Oxygen Co. Ltd. The maximum amount of build-up should not exceed ½ in. and it is emphasised that if deformed or cracked rails are present the servicing must be by replacement instead of welding. The welding rod used for resurfacing is known as Wear Resisting Alloy Steel. This is an alloy of medium carbon steel, chromium, manganese and silicon, with a low sulphur and phosphorus content. Deposits are made over the worn area in sections of about 2 in. long, each section being hammered to a level surface under blowpipe flame. The section is subsequently forged to the rail contour by blacksmith's square flatter. A considerable amount of welding is also undertaken on electric track conductor rails and running rail traction bonds. On this work 40,000 bonds are welded annually.

Disc brakes on British Railways

BRITISH Railways are placing in regular service freight vehicles with disc brakes; these have the distinction of being the first wagons in regular service with this type of brake and are also the first in which the wheel itself constitutes the disc. This adaptation has been developed under the direction of the Chief Mechanical Engineer of the British Transport Commission's Central Staff, in conjunction with Girling Limited, and is to undergo large-scale trials on 212 coal wagons of three types. In addition to the principal advantage of far-longer periods between brake-pad renewals, disc brakes can also achieve a more consistent braking performance, and much better heat dissipation, without the disadvantages of other thermal effects, including brake fade. Some British passenger vehicles are also equipped with disc brakes and have been put in experimental service as part of a series of long-term trials which are in progress.

Railway use of the disc brake

THE disc brake has had a long and generally successful application to passenger stock, in the form of normal coaches, electric multiple-unit trains, and diesel railcars. The first service applications on any scale were 27 to 28 years ago. Two mechanisms have found general use: discs on the axle and discs attached to the wheel centre. The latter has certain advantages in regard to surface to which the retarding force can be applied and also in regard to cooling; but to find space for it is usually difficult, and probably the disc on the axle arrangement is more common, and is applied, for example, to the 800-odd Verdingen railbuses in Germany and elsewhere and to certain high-power diesel trains. The principal advantage of the disc brake is that it more or less eliminates one of the two major variables in brake performance, that is, the variation in friction between brake block and tyre at different track speeds. It thus tends to make everyday brake performance more uniform and more predictable.

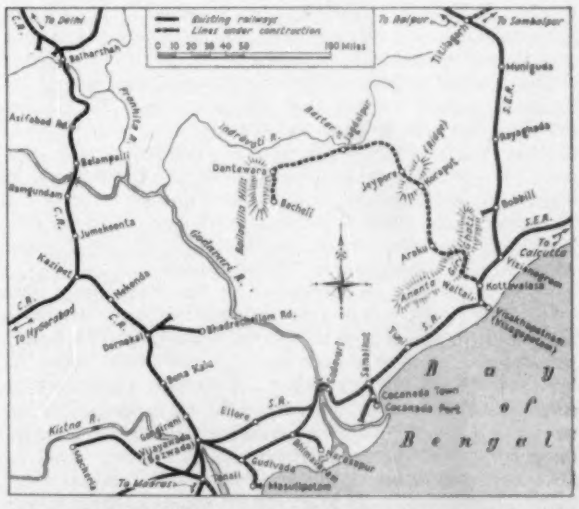
Iron-ore railway for India

IN one of the most remote parts of India is the Bailadilla range of hills containing one of the most valuable deposits of high-grade iron ore in the sub-continent. The geological survey of India estimates that the deposit consists of at least 300 million tons of 65 per cent haematite associated with a minor percentage of magnetite and low sulphur and phosphorus contents. If fully exploited, it should realise foreign exchange to the value of over £11,000 million at current export prices.

Unfortunately, no coking coal is available within reasonable distance of the deposit, and it is not economically possible to establish an iron and steel plant nearby. On the other hand, it was evident that if this volume of ore could be transported to the coast its export value would still be very considerable. The obvious port of export both on the score of its distance from the deposit and of its fine large natural harbour was Visakhapatnam (Vizagapatam) on the Bay of Bengal, already being equipped for iron ore shipment; that ore will be railed via Sambalpur over a new line to Tililagarh, on the existing line from Raipur.

It was at first suggested that the ore should be carried to the coast by a new line of railway to be built from the Bailadilla deposit to the Godavari River and thence by boat down to its mouth for transfer to ocean vessels there. A second alternative was to carry that railway across the Godavari to join the Balharskah-Kazipet-Vijayawada railway, and use that and the east coast main line onward to Visakhapatnam. Both these lines are already extremely congested and this route would involve two new bridges of great length over the Godavari, the second to duplicate the existing one near Rajahmundry. This route would also have involved a very long detour, and both these alternatives were ruled out in favour of a comparatively direct new line of railway from Bacheli, the terminus under the Bailadillas, via Jagdalpur to Kottavalasa, a station on the east coast line near Visakhapatnam.

In view of the mountainous country traversed by this line it was obvious that its construction would be very costly, and could therefore only be justified if a firm demand for export of the ore was forthcoming. However, just such a demand came from the Japanese Government for 4 million tons of this ore to be shipped annually for a period of ten years. In fact, that Government has also offered financial assistance to meet the foreign exchange requirements of the mining and railway projects.



Accordingly, all arrangements are in train to complete the construction in time for export to Japan to begin in 1966; the survey is just being completed. Construction preliminaries are in hand, staff, materials and plant being collected.

The distance as the crow flies from Bacheli to Visakhapatnam

is only about 120 miles, but the intervening country necessitates considerable detour of the railway from it; in fact it will be about 270 miles in length. At Bacheli the altitude is about 1,750 ft. and the line falls through 550 ft. in the initial 20 miles to Dantewara. It then has to rise to 2,300 ft. to cross the Kodenar Range, whence there is a fall to the Indravati River valley at Jagdalpur, the Bastar District headquarters.

Comparatively easy terrain follows at about 1,900 ft. altitude as far as Jeypore, where difficult country is entered in a climb to reach the Koraput Plateau, 2,900 ft. Heavy earthworks including tunnelling are necessary on this ascent. Rising but undulating country is then traversed through Paduwa to Simliguda, at the top of the Eastern or Anantagiri Ghats, altitude 3,270 ft.

The descent down the escarpment to the maritime plain in the succeeding 41 miles is reported to be the only feasible route. This is the most difficult part of the new line, and even with a 1-in-70 gradient the sharp-featured spurs and deep gorges will necessitate not only deep cuttings and high banks and viaducts, but also some 40 tunnels with an aggregate length of about 30,000 ft. or nearly 5¾ miles. It is this costly construction work that is bound to force up the cost of this 270-mile line to at least £41 million.

As about half this distance is on steep gradients operating costs also are likely to be high. Though roughly ⅔ of the total rise and fall would seem to be in favour of the loaded ore trains, the remaining ⅓ on the rising gradients will have to be faced. In the absence of details, the figures and facts given above are in some cases surmise, though they are almost all based on a published article by Mr. B. S. D. Baliga, Chief Engineer of railway projects in this and adjacent areas.

Italian summer train services

THE summer timetables of the Italian State Railways show continued progress toward higher speeds. Even on the minor lines and branches there are few which do not show some paring of times of the majority of their trains, generally by not more than 4 to 10 min., but amounting in the aggregate to a considerable time economy. Over its principal main lines Italy ranks third in speed only to France and Germany, and a number of runs are timed from start to stop at from 60 to well over 70 m.p.h. The fastest run in the last timetable, of the first class "Vesuvius Arrow" from Rome to Naples, 130·5 miles, has been slowed from 100 to 105 min. each way (78·2 to 74·6 m.p.h.), but over its entire journey of 521·1 miles between Milan and Naples, with stops at Bologna, Florence and Rome, this express is allowed 8 hr. only (65·1 m.p.h.).

The luxury "Settebello" express also has been slowed by 5 min. to a 6-hr. schedule from Milan to Rome, 390·8 miles (65·1 m.p.h.), with Bologna and Florence stops; northbound, there is a further stop, at Piacenza, and the Bologna-Piacenza booking, over 91·2 miles in 72 min. (76 m.p.h.) is the fastest in Italy. The southbound "Settebello" is booked to cover the 135·5 miles from Milan to Bologna in 109 min., at 74·6 m.p.h. There are other Milan-Bologna runs in 111, 120, 124, 130, and 131 min., and northbound in 119 and 131 min.

There is also high-speed running on the Milan-Venice line, in particular by the first class "Rialto," covering the 165·4 miles in 2 hr. 35 min. (64 m.p.h.) with four stops; the fastest point-to-point timing is over the 91·7 miles from Milan to Verona in 78 min. (70·5 m.p.h.). This provides a fast morning service at 7.10 a.m. from Milan, and there is a similar evening service at 4.50 p.m., with corresponding trains in the opposite direction, the Italian principle (as also in France) being to have high-speed morning and evening luxury trains, at extra fares, over its chief main lines, for the use of business executives and others. An interesting feature of the eastbound "Rialto" working is that, as far as Verona, this train is worked multiple-unit with the T.E.E. "Mediolanum," which runs from Milan to Munich by the Brenner route.

Another similar multiple-unit working is on Saturdays, when the 2 p.m. first class "Dolomite Arrow" from Milan has attached as far as Verona the "Atesina Arrow" for Bolzano and Merano. The latter is due at 5.50 p.m. in Merano, where the turn-around time allowed is only 10 min., the return to Milan being at 6 p.m., with an arrival at 9.35 p.m. Three Austrian services of interest using the Brenner route are the so-called "privilege" diesel railcars between Innsbrück and Lienz in Southern Austria, via Fortezza, the Pustertal and San Candido; these pass through Italian territory without stopping between the frontier stations of Brennero and San Candido, and passengers are therefore exempt from passport and customs examinations. The trains leave Innsbrück at 7 a.m., 1.15 and 5.23 p.m., and Lienz at 4.50 and 8.55 a.m. and 6.58 p.m., taking 3¾ to 4¼ hr. on the through journey.

The new Swiss T.E.E. services, beginning on July 1, in addition to their own journeys, will add considerably by connections to the possibilities of long-distance day travel. For example, the 2.55 p.m. "Cisalpin" from Milan to Paris will be in connection with the 10.28 a.m. from Venice and the 10.31 a.m. from Florence, giving an arrival in Paris at 10.55 p.m., as well as making Swiss connections to Geneva and Berne. The 4.40 p.m. arrival of the 4-hr. 12.40 p.m. "Ticino" from Zurich (itself in connection with the 7.45 a.m. "Schauinsland" from Frankfort) will connect at Milan with the 5.45 p.m. "Settebello" for Rome, reaching there at 11.45 p.m., while the 8.45 a.m. "Gottardo" from Zurich, arriving at 12.45 p.m., will connect with the 1 p.m. express from Milan, arriving in Rome at 7.49 p.m. and Naples at 10.4 p.m. Equally in the northbound direction passengers off the 8.50 a.m. from Rome will have 22 min. in Milan to catch the 5.5 p.m. "Gottardo," reaching Zurich at 9.5 p.m.

The introduction of the new "Chopin" through sleeping-car service between Vienna and Moscow, with a through sleeping-car three times each week between Rome and Moscow, is being accompanied by Italian accelerations. The 9.30 p.m. from Rome, conveying this car, reaches the frontier station of Tarvisio 45 min. earlier than previously, at 10.20 a.m., and Vienna 70 min. earlier, at 6.40 p.m. Southbound, the former 10 a.m. from Vienna starts 80 min. later, at 11.20 a.m., but reaches Rome only 10 min. later, at 8.45 a.m.

Accelerations have been effected also in Sicily. The "Treno dell'Etna," with through Turin-Syracuse coaches, 23 min. earlier from Turin, now reaches Syracuse 53 min. earlier, at 6.45 p.m. A number of train times between Messina and Syracuse and Messina and Palermo have been cut.

Some American railway reports

BY A CORRESPONDENT

IN these days the annual reports of U.S.A. railways are interesting documents. They differ widely in format, but many of them are printed on excellent paper and illustrated copiously. The Santa Fé, operating 13,000 miles of road across 12 States between Chicago and San Francisco, produced its 66th report for 1960 in a neat pamphlet of 52 pages. The cover depicts a freight train, hauled by four diesel units, passing over a new route in Arizona, which will reduce working costs and also improve the service. Last year the Santa Fé acquired 85 diesel units, bringing the strength of its diesel power to 1,862 units. It was able to raise the speed of freight trains to 25·3 m.p.h., compared with the all-line average of 19·5. An advance of 1·3 per cent on 1959 in the Santa Fé passenger revenue may have resulted in part from the running of passenger services at 51 m.p.h. when the general average was 40·7.

Last year the Santa Fé's freight revenue was over $514 million, earned by moving 65·3 million tons for an average distance of nearly 561 miles. But there are small railways in the States! In the northern parts of Maine the Bangor & Arvostock works 595 miles of road. It has given up rail passenger business, save for one coach at the end of a mail train, but owns a fleet of road buses which produce receipts of over

$200,000 a year. Last year it earned $12·7 million by carrying 3,554,830 tons for an average distance of 135 miles. This tiny railway paid a dividend and for the sixth time chose a picture by a Maine artist for the cover of its annual report. The view of the rugged Maine coast reminds one of the Brillers of Buchan in Aberdeenshire.

The Chesapeake & Ohio has a unique way of doing many things. On the first working day of each new year it sends a "flash annual report" to shareholders with results for the previous 12 months. This year's missive said that, for the fourth time, dividends would be $4 a year per common share, while at the beginning of 1961 the railway was stronger than ever before. Net income for 1960 was $42 million and working capital at the year end was $63 million. That is the difference between current assets and liabilities; it represents the liquid reserves of the railways which supply funds for current operating costs, for making down payments on equipment purchases, and for financing other improvements.

The main report enlarges on the proposal for affiliation between the C. & O. and the Baltimore & Ohio Railroad, leading up to a merger between the two railways which would create a system of more than 11,000 miles of line, estimated to produce the second largest revenue of any railway in the States. The scheme is being considered by the Inter-State Commerce Commission. Meanwhile, we are assured that "the marriage which B. & O. and C. & O. now seek and the benefits it would bring to the nation were foreshadowed 175 years ago in the plans of George Washington." He helped to create two canals in the region of the James and Potomac rivers, but it is a far cry to the Great Lakes which the two railways now reach at many points.

When the Illinois Central celebrated its centenary in 1951, Mr. Carlton J. Corliss wrote an excellent account of its rise to become the "main line of mid-America." At that date Mr. Wayne A. Johnston had been President for six years and still directs its operations. In the report for 1960, he claims to have built muscle into these operations with new equipment and better facilities, as well as drastically reducing funded debt. The railway was thus in good shape to face a decline of 4 per cent in total revenues last year and paid dividends of $2 per share of capital stock. About a third of the freight tonnage moved was coal, of which 56 per cent went to steam electric generating plants.

In August a new office building, owned jointly by the I.C. and Santa Fé, was opened at the Chicago Produce Terminal, which is used by 31 railways, and is the largest fresh fruit and vegetable market in the world, able to handle 2,500 wagons at one time. The I.C. increased total passenger revenues one per cent to $22·6 million. Through passenger revenue was up 2 per cent, indicating that many Americans still prefer to travel "in well-maintained trains staffed by able and courteous personnel," the annual report states. It adds that "the prestige of the Panama Limited is at an all-time high."

Another famous passenger train, "The Empire Builder," hauled by diesel power, is shown on the cover of the Great Northern report wending its way through the Montana Rockies. The scenery is magnificent, but passenger revenue declined faster in 1960 than freight receipts and, though vigorous efforts reduced expenses by 1·6 per cent, the operating ratio was 78·9 per cent against 77·4 in 1959. Efficiency was fully maintained. A net train-load of 1,428 tons moved at an average speed of 20·5 m.p.h. raising the hourly output of freight train operation to a record of 64,800 gross ton-miles, 41 per cent above the 1950 figure.

The palm for efficient handling of freight train traffic goes to the Union Pacific, which operates 9,740 miles of road between Omaha and the Pacific coast, often in difficult country. Though ton-mileage was down from 1959, the "U.P." raised its train load to 1,401 tons, had a freight speed of 27·7 m.p.h., and turned out 92,120 gross ton-miles in a train-hour, 4 per cent above the 1959 output. It is gradually adding to a small stock of gas-turbine locomotives, having eight more on order in January; the other western railways are content to strengthen their diesel motive power.

LETTERS TO THE EDITOR

THE EDITOR IS NOT RESPONSIBLE FOR THE OPINIONS OF CORRESPONDENTS

WHY BOAT TRAINS ?

June 14

SIR, It is always regarded as unforgivable for voyagers to refer to either a ship or a vessel as a "boat," but nevertheless, the special trains which convey passengers to the said ship or vessel, are invariably called "boat trains." Which term is correct ?

Yours faithfully,

GUY HARRISON

45, St. Martin's Lane,
London, W.C.2

POSTERS AS PROPAGANDA

June 12

SIR, I sometimes wonder whether railway posters are being used to full advantage. In the case of rail fares, for instance, much public resentment is felt over what is believed to be a high level of charging. A poster series could do much to break down this ill-feeling by showing that a rail ticket buys a good deal more service than a coach ticket. If when travelling in a bus one passes men repairing the road, the men's work is not a direct charge on one's ticket; but a permanent way gang at work is a direct charge on a railway ticket. This argument is perhaps a little simplified, but it can generate a new attitude.

People do not resent road hold-ups as greatly as they do rail delays because they can imagine the cause. The working of a railway is a closed book to most travellers. Posters showing facsimile pages of operating and diversion notices, wrong line orders, etc., could open a new world of comprehension.

I firmly believe in the unique nature of scenery seen from a train. A scenic rail route is a precious thing and posters should be given an edge to arouse appreciation of this. Touring by train could become the "done" thing.

Valuable publicity could follow an annual *concours d' elegance* for the remaining British Railways steam locomotives. Organised on an inter-regional basis at selected centres, it could become the focus of much enthusiasm and a source of traffic.

There is no shortage of interest in railways in our land. The urgent need is to channel it into the desire to spend money in using railways.

Yours faithfully,

WILLIAM B. STOCKS

22, Heatherfield Road,
Marsh, Huddersfield

CHECK ON RAILWAY EXPENDITURE

June 12

SIR, Your account of the precarious state of American railroads, published on June 9, told more about 220,200 miles of road in the United States, operated by 106 companies, than we know about the 18,565 miles of our railways. The Association of American Railroads' statement of railway revenues and expenses to March 31, on which your article was based, reached London before the end of May. On May 6 the British Transport Commission circulated No. 3 Transport Statistics, giving details of passenger journeys and takings for February and operating statistics to March 26. It was accompanied by a forecast of gross traffic receipts to April 23, but gave no hint

of the trend of expenditure or of net revenue results, two matters that are of primary importance during the present state of emergency.

There is ample room for enlivening our accountancy and statistical methods. The Chesapeake & Ohio Railway operates 5,090 miles of road—more than any Region of our railways covers. It collects financial information so quickly that it can report each month's results on the first day of the following month. To shareholders the C. & O. sends a " flash annual report " on the first working day of the new year. For the last four years the preliminary report announced a dividend of $4 a share, made possible by the operating ratio being below 78 per cent.

Our railways cannot be expected to rival that feat of accountancy, but they ought to have promptly the essential information required to keep operating expenditure within reasonable bounds. The taxpayers, who have, in one way or another, to make good the deficit on railway workings are also entitled to know what is being done with their money.

Yours faithfully,

R. BELL

Clacton-on-Sea

RAILWAYS INTO ROADS

June 10

SIR, It would be most interesting to know how many miles of railway in Britain carry 1,000 seated passengers past one point on one line at 2-min. intervals.

If this was kept up for a full hour, 30,000 passengers would be moved on a 12- to 16-ft. wide route which is certainly a remarkable achievement. Perhaps Mr. C. Hamilton Ellis can provide us with information on where this is being done.

Meanwhile, I would like to point out that, if the railways were converted into motorways, the 30,000 passengers could be moved by 500 60-seater buses in 1 hr., and I don't see why a speed of 70 m.p.h. should not be quite feasible considering the fact that the buses would be controlled by specially-trained drivers. It must also be taken into consideration that there would only be a flow of 500 vehicles an hour, a very modest figure for a lane of motorway, when compared with American conditions where flows of 1,500 to 2,000 vehicles an hour are quite common.

In the case of London, there are 70 rail tracks at a three-mile radius from Charing Cross. In peak-hours, 240,000 passengers are carried. If eight of the 70 lanes were reserved exclusively for buses there would still be 62 lanes of motorway for cars and trucks, etc.

Outgoing traffic would have to be accommodated during the morning rush, but even if we had 40 incoming lanes and 30 outgoing lanes there would still be 32 lanes of motorway available for private cars and commercial vehicles and the 240,000 public transport commuters could all arrive seated.

Yours faithfully,

A. I. WATKINSON

3, Otley Road,
Harrogate, Yorkshire

June 9

SIR, To Brigadier T. I. Lloyd's suggestion that between Shenfield and Liverpool Street stations the Great Eastern Line could efficiently deal with the same goods and passenger user, motor-borne, on more traffic lanes but without widening the formation, than it presently does on rails, one can only quote Swift's polite and upright horses, who sadly told Gulliver: " But you are saying that which is not ! " As for arithmetic, I suggest that Brigadier Lloyd knows perfectly well what funny things you can do with it. According to meticulous calculations based on the Great Pyramid, the world came to an end some years ago, *cf.* tracts issued in the 1920's.

We still wait for the details, for which I put out a gentle feeler in my last letter, of the Railway Conversion League's plans for that particular line, with its terminal facilities including the passage of traffic into Central London, and proper diagrams of vehicle movements. One fears that these make more of a task than the possible conversion of the poor old Midland & Great Northern Joint Railway, and even there one gathers that certain people of North Norfolk don't want it; they want real roads, designed for motors.

Much as most of us like having motor cars, we must admit that the private motor is the most wasteful and uneconomic unit in land transport. One needs only to quote, not some enthusiastic railwayman, but the Deputy Director for Traffic & Safety at the Road Research Laboratory, Dr. R. J. Smeed. For commuting passenger traffic he gave the following proportions of traffic space to working space: With urban motorways, private cars occupy 17 per cent, plus 10 per cent parking space, leaving 73 per cent working space. In an ordinary city, private cars would occupy 60 per cent, plus 5 per cent parking space, leaving 35 per cent working space. With bus transport the percentages are 14 per cent narrow road, leaving 86 per cent working area, which is much better. But the equivalent space occupied by railway transport in a city area comes to no more than two per cent against 98 per cent working space. One cannot accept Brigadier Lloyd's suggestion that conversion of railways to roads would entail no increase in area. To a dispassionate surveyor, the idea is *plain dotty*.

Yours faithfully,

C. HAMILTON ELLIS

Southesk, Mannings Heath,
Horsham, Sussex

THE SHAPE OF THINGS TO COME ?

June 9

SIR, I read, with amazement, the article on the Western Region's latest timetable project. Slower trains and more of them would appear to be the basic principle of this startling blueprint for progress. There are to be a few faster ones, timed at the exciting average speed of just over 60 m.p.h.—presumably to avoid straining our ultra-modern traction units !

Seriously though, is this the pattern to be adopted by every Region in the near future, and, if so, what is the underlying motive ? Can it be the fear of unpunctuality, always just round the corner ?

In the last decade or so, various measures have been taken in the hope that better time-keeping would result; these may be summarised as:—

i. A modest speed-up all round.
ii. Recovery margins plus " squeezed " times, leaving the over-all schedule virtually untouched.
iii. Recovery margins " à outrance," producing a far from modest slow-down all round.

Unfortunately, the outcome of all these plans was, to misquote Danton: " *de l' inexactitude, encore de l' inexactitude, toujours de l' inexactitude.*" Nevertheless, I feel sure that, if a comprehensive review of past statistics were to be undertaken, those relating to " Régime No. 1 " would present the least sombre picture.

Speed is essential if long-distance passenger traffic is to be retained; so too are comfort and reliability. The dish placed before the exigent traveller should combine all three, but without being stingy with the first ingredient.

I shrink from exhorting our people to take a penetrating look at what is going on " over the water," when the attitude of so many can be summed up in the words: " To blazes with you, Jacques (or Johann), I'm all right."

The unpunctuality disease requires specialist treatment, but the cure is not to be found in slower trains, and in voicing this opinion I fear I am impenitent.

Yours faithfully,

J. E. L. SKELTON

Rua Afonso Sanches,
Lote ' C '—2°E., Cascais, Portugal

The Scrap Heap

The last train

The Hawkhurst branch line from Paddock Wood was closed by the Southern Region of British Railways on June 10 and when the last train left Paddock Wood at 7.25 p.m. it was given a ceremonial send-off. The Stationmaster wore his top hat and boarded the train with a party of people dressed in old-time costume. The illustration shows R.I.P. notices being put on the carriages which were decorated with bunting for the occasion.

Keyed up?

A set of keys were found at Paddington Station, British Railways, Western Region, recently, and handed in to the Lost Property Office. They proved to be a set which had been lost by a member of the staff at Wormwood Scrubs prison. An intensive search of cells and corridors had been made for them in the prison in case they had been picked up by a prisoner.

Still in use

Restaurant car No. 10222 of the Swiss Federal Railways, built in 1914 at Smichov in Czechoslovakia (then Bohemia) and the first Swiss-owned restaurant car to enter service, has now been withdrawn and has found an honoured resting-place in the national Transport Museum at Lucerne, where it will be used for the service of meals and refreshments.

Returned empties?

A special train left Irvine, Ayrshire, on June 13, with the second part of a consignment of a total of 2,000,000 beer bottles bound for New Brunswick, Canada. The bottles left in twenty-seven wagons for Manchester. They will be loaded there ready for shipment across the Atlantic.

Angels' flight railway

The quaintly named "Angels' Flight" railway in Los Angeles, California, claims to be the world's shortest and that it has carried more passengers per mile than any other. The line, which is only 315 ft. long, with a gradient of 1 in 3, has carried more than 100 million passengers at a fare of 5 cents (approximately 4d.)—since it was opened in 1901. Built by Colonel J. W. Eddy, who was a close friend of Abraham Lincoln, the 16th President of the United States, the line also claims a remarkable safety record: not a single passenger has been killed or seriously injured. The rolling stock consists of two counter-balanced cars, each seating 32 passengers, and as one car goes downhill, the other is pulled up. The cars are constructed like a flight of stairs, and inside it is just like sitting on a staircase with the central gangway constructed in a series of steps. The engine driver/ticket collector/booking clerk/stationmaster sits in the pilot house at the top of the incline controlling the 50 h.p. motor and brake. The days of the "Angels' Flight" railway are numbered but not through lack of patronage. Town planning schemes now under way will force the line to close, although it may well be placed elsewhere.

Sole a la Metropolitan

In the days when the Inner Circle was worked by steam locomotives, the water and the side tanks of the former Metropolitan and District Railway engineer became so hot, as the result of condensing the exhaust, that it had to be changed every time round. While this had serious difficulties from the operating point of view it had the attraction of providing the crew with a convenient means of preparing hot meals. To boil fish all that was required was a piece of wire twisted round the tail and hooked over the neck of the filling orifice. These facilities were extended to the guard, but if he had fallen foul of the footplate crew the results were sometimes overdone. It was not unknown for the enginemen to forget to remove the guard's meal when it was cooked, with the result that, on calling to collect his meal, he was presented with a skeleton on the end of a piece of wire. The cooking of eggs and bacon on a shovel placed inside the firebox door was a practice indulged in almost wherever there were locomotives, and shovels sufficiently clean to meet varying standards of hygiene. This too could have its drawbacks for use of the blower has resulted in many a meal going up in smoke.

Knocking the rock

A tunnel has again been driven through the fabled Lorelei Rock on the right bank of the Rhine as part of the railway electrification scheme between Kaub and Ruedesheim. The first tunnel was cut in 1860 but it is too low to permit installation of electric wiring. First electric trains are expected to pass through by the end of the year.

Tyrol terrorists

Terrorists recently blew up the electricity supply line in Alto Adige in the South Tyrol as a demonstration against Italian oppression.

Blue murder

The Bluebell line, the branch from Sheffield Park to Horsted Keynes in Sussex, closed by the Southern Region of British Railways and now run by a group of enthusiasts as a "Scenic" railway, was featured in the Independent Television Authority's "No Hiding Place" last Friday. With the name altered to "The Meadow Line" it became the scene of a murder.

R.I.P. notice for the last train from Paddock Wood to Hawkhurst

OVERSEAS RAILWAY AFFAIRS

FROM OUR CORRESPONDENTS

NEW ZEALAND

Wellington-Picton ferry

The New Zealand cabinet has approved the expenditure of some £85,000 as the Railways Department's share of the cost of the terminals for the new ferry service between Wellington (North Island), and Picton (South Island). Work is in hand at both terminals, and the ferry vessel is being built in the United Kingdom. At Wellington several sidings are having to be moved as well as bulk bitumen and oil-fuel loading facilities. Four new sidings will be required to serve the ferry wharf, and others will be extended for wagon storage. The existing Picton marshalling and storage facilities will suffice.

VICTORIA

New suburban stations and overbridges

A new station named Patterson has been built on the Melbourne southern suburban line to Frankston between Bentleigh and Moorabbin. It consists of an island platform, buildings and ramped entrance. Space for a future third track between Moorabbin and Caulfield has been allowed for. At Newport and Elsternwick two new overbridges are more than half completed.

SOUTH AFRICA

Rolling-stock augmented

During the first quarter of 1961, the South African Railways administration placed 23 electric (Class "5E1"), 11 diesel-electric (Class "32"), and five 2-ft.-gauge locomotives in service. The narrow-gauge engines were built by the Tsumeb Corporation of South West Africa. During the same period, 76 coaching vehicles and 1,012 goods vehicles were placed in traffic. Meanwhile 19 coaching and 599 goods vehicles as well as one narrow-gauge locomotive were withdrawn from service.

MOZAMBIQUE

Port and railway improvements

Beira, which is one of the largest ports on the east coast of Africa and the principal outlet from Rhodesia to the sea, is to undergo considerable expansion. During the next five years the Portuguese Government is to spend £12 million on additional berths, sheds, and handling facilities at the port and on the realignment and re-laying of the railway from Umtali, on the Mozambique-Rhodesian frontier, to Beira. The work will provide berthing accommodation for 10 ocean-going vessels simultaneously.

INDIA

Rail concession to foreign tourists

The Deputy Minister of Railways in India, announcing the Government's new "Welcome to India and Visit the Orient" scheme, said that on production of a certificate from an authorised officer of the Tourist Department of the Government of India, foreign tourists on Indian Railways were now allowed a concession of 25 per cent in "air-conditioned" fares and in "travel as you like" tickets available for 30 days in air-conditioned accommodation, and in first class where air-conditioned accommodation was not available, at a lump sum rate of £37 2s.

TURKEY

New coaching stock

The Swiss company of Schlieren (Schweizerische Wagons und Aufzugefabrik A.G.) has recently built for the Turkish State Railways six 73-ft. coaches closely resembling the latest standard coaches of the Swiss Federal Railways. They are to be used in the "Tauern Express" service between Munich and Istanbul *via* Villach and Belgrade, and are being financed by Eurofima.

SWEDEN

260-ton 131-ft. flexible wagon

The Swedish State Railways has on order a special wagon capable of carrying a load of 260 tons as compared with the highest capacity in use of 173 tons. Designated Q. 51, the wagon is designed to meet the needs of ever-increasing industrial loads, and is to be delivered this summer by the manufacturer, Chr. Olsson of Falkenberg. It has an overall length of nearly 131 ft., weighs 100 tons and is carried on 18 axles each loaded to up to 20 tons. The design of the bogies enables Swedish 4-ft. 8½-in. gauge wheels to be changed to the 5-ft. Finnish gauge while the wagon is under full load. The vehicle is so flexible that it will negotiate 262-ft. rad. curves, and the saddles with girders and load can be moved 8 in. either side of the centreline by compressed-air motors within 30 sec.

FINLAND

Centenary of Finnish State Railways

A committee has been formed to supervise the preparations for the centenary of the Finnish State Railways, scheduled to take place on March 17, 1962. Mr. Erkki Aalto, General Manager of the system, has been nominated its Chairman. A subcommittee has been appointed to work out the organisation of a general and an exhibition section.

SWITZERLAND

Higher speed limit

For the new Swiss T.E.E. train "Cisalpin," which is to begin running on July 1 on an 8-hr. schedule between Paris and Milan, the Swiss speed limit is being raised to 140 km.p.h. (87 m.p.h.) over various sections of the Simplon main line in the Rhone Valley east of Martigny and also through the Simplon tunnel. A sustained speed at this level also will be necessary between Paris and Dijon.

ARGENTINA

National development

In a message at the opening of the 93rd session of Congress at the beginning of May, President Frondizi listed the objectives for the coming three years. These include the building of 40 airports; intensive development of the aircraft and shipbuilding industries; the modernisation and extension of the Buenos Aires urban transport system, and the co-ordinated development of roads, railway network, and river and air transport systems.

CHILE

Copper concentrates by pipeline

For the past year, copper concentrates have been satisfactorily and economically transported the 14 miles from the Anaconda mine to the smelting plant by pipeline instead of by railway. The single pipeline has carried over 173 million lb.

A FUNICULAR RAILWAY in Penang

Construction and operation of a state-owned amenity line

THE first attempt at constructing a funicular railway on Penang Hill began with the formation in 1897 of a limited company in Penang. Construction was completed in 1906 but the design was faulty and the enterprise was abandoned.

After the 1914-18 war the Straits Settlements Government desired to develop Penang Hill as an amenity in the same way as the Federated Malay States Government was developing Fraser's Hill and the Cameron Highlands in central Malaya. It was decided that the Government should construct a funicular railway, and an engineer in the Government service was sent to Switzerland to acquaint himself with methods of designing a funicular railway to be operated by electricity. The Penang Hill Railway was constructed under his direction, and was officially opened on October 21, 1923.

Two independent sections

The Penang Hill Railway is built in two sections, each worked independently. The total length of the line along the formation level is 1 mile 435 yd. and it rises 2,270 ft. The mean gradient is about 1 in 3 and the maximum gradient is 1 in 1·96. The centre of the Upper Station is 2,381 ft. above sea level.

The car speed is 1·1 metres per sec. on the lower section, and 1·3 metres per sec. on the upper section. The middle of each section includes a crossing place where the ascending and descending cars pass. Each car has two axles and the wheels on one side only are grooved so that each car can be correctly guided to follow the tract at the crossing.

A car running into the crossing loop on the lower section of the railway

Upper section, where ascending and descending cars pass

Automatic brakes are provided on each car to halt the car in the event of breakage of the haulage rope. The brakes are held in the " off " position by tension in the rope. When the brakes operate, brake shoes are clamped to the sides of the rail at each wheel, the downward motion of the carriage being geared to supply the necessary power for clamping the rails. The brakes on each car are tested every six months. These brakes will bring the car to a stop in a distance of 1-1·5 metres.

Precautions in winding house

There is also an automatic brake in each winding house which operates on a failure of the electricity supply and arrests the movement of the winding gear. This brake is tested daily.

The winding engines are at the upper end of each section of the railway, and have a safe pulling power of 9 tons. The winding gear is of the friction drive or " Koepe " type, motive power being provided by a 75-h.p. electric motor direct coupled to the friction pulley through gearing. The motor is supplied with d.c. current by a 100-kW. mercury-arc rectifier unit fed from the 3-phase 50-cycle 11,000-V. public electricity supply mains.

The car underframes, including the automatic safety brakes, were designed and manufactured by the Louis de Roll Ironworks, near Olten, Switzerland, as were also the winder superstructure and cable guiding pulleys. The winding gear was manufactured by Robey & Co. Ltd., of Lincoln, England.

Locked-coil haulage ropes

Each haulage rope is of the full locked-coil type of construction, 3·875 in. in circumference and has a breaking strength of 71·5 tons. The special steel used for its manufacture has a strength of 80/90 tons per sq. in. and the weight per yard is 11·25 lb.

The total weight of the upper section rope is 6·6 tons and the lower section rope weighs 5½ tons. Each car underframe weighs 5 tons, the car body 2½ tons, and 2½ tons is allowed for passengers, giving a total weight of 10 tons per loaded car. One loaded freight wagon weighing 3½ tons can be operated with each car; the freight wagon is run uncoupled on the upper side of the passenger car.

Various patterns of freight-wagon body are in use according to the type of freight carried.

Continued on page 707

JACKING A 10-FT. DIA. CONCRETE PIPE for storm drain

Pipe-line headed by boring machine forced 1,200 ft. at a depth of 75 ft.

It is occasionally necessary to construct culverts through existing railway embankments, and sometimes they are in the form of pipes pushed through the earthwork with the aid of jacks. They are seldom of large diameter or of great length.

Recently in California a line of 10-ft. dia. concrete pipes was pushed through a 1,200-ft. length of ground at a depth of 75 ft. The methods used might be adapted for long railway culverts or even for tube tunnelling.

The pipe-line was driven through a heading excavated mechanically at its leading end as it was jacked forward. Driving was carried out from one primary and four intermediate jacking-pits with the assistance of an attached circular boring head preceding the pipe-line, a special lubricant to ease its passage, and a method of steering by varying the tension in steel channels making the first four pipes and their joints a rigid assembly.

Soil conditions

The soil consisted of hard, dry clay, cemented sand, and loose gravel almost amounting to a conglomerate, as well as some loose sand. There was no solid rock, running soil, or ground water. The pipe-jacking scheme had great advantages over open-trench construction as the pipe-line had to be laid as much as 75 ft. below the surface and the land-width was only 100 ft., conditions that would have necessitated almost prohibitive open-trench shoring. It left the overburden practically undisturbed, so that less reinforcement was required in the pipes than if the system had been installed in a trench.

The boring machine and a steel cutting-edge were attached inside the leading pipe section. A rotating ring on the machine had five arms fitted with hard-faced teeth in a staggered pattern, the outer teeth turned outward so that the resulting bore was a little larger than the pipe. The cutting-edge was also larger than the pipe so that there was a ¼-in. to ½-in. annular space round the pipe throughout the 1,200-ft. length of the job. The cutting-edge had a pipe-manifold and injection system through which a lubricant was pumped into the annular space.

Boring machine as completed in fabricating shop

Four 250-ton jacks extended in jacking-pit, and having 13-ft. 6-in. stroke

The cutter was powered with a 20-h.p. air-motor through a flexible-coupling, variable-speed controller and chain-drive. The excavated material fell into vane-type buckets behind the cutting-head whence it was lifted to the top of the pipe. There it fell on a conveyor-belt and was carried to a hopper 12 ft. from the cutting-face.

Hydraulic doors to hopper

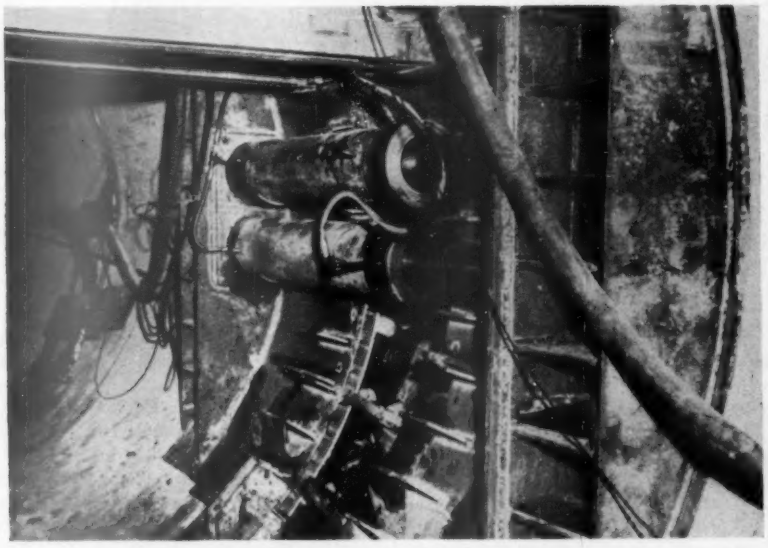
The hopper had hydraulic doors through which the material discharged into a battery-driven rubber-tyre 2-cu. yd. muck-car fitted with a removable skip for hoisting the muck out of each jacking-pit.

The 10-ft. bore pipe sections used were 12 ft. long and 11 in. thick. Each weighed 30 tons. One section at a time was lowered into the primary jacking-pit to be added to the pipe-line. This was driven forward by four jacks each with a stroke of 13 ft. 6 in. and a capacity of 250 tons; they were powered by a two-stage hydraulic pump with a pressure of 1,800 lb. per sq. in. The cutting-head worked its way forward 1 ft. 8 in. at a time and was then withdrawn for the pipe to be jacked ahead, enabling the cutter to take a fresh bite.

Intermediate jacking stations

As the 1,000-ton thrust of the four jacks would not push the pipe-line the full 1,200-ft. length, four intermediate jacking stations were provided, three equipped with four 200-ton jacks in each and one with two only. At each of these stations a steel sleeve 5 ft. long and fitting round the pipe was attached to the preceding spigot-joint to prevent the infall of overburden and sloughing soil when a gap was made to insert the jacks which had a 4-ft. stroke. At this point also, a 10 in. x 3½ in. circular channel was inserted to preserve the gaps between pipe-lengths.

When it became necessary to insert a



Intermediate jacking-station, showing two of the 200-ton jacks in position and steel shield on preceding spigot-joint

set of intermediate jacks this channel was burnt out and fabricated steel rings bearing against the pipe-joint faces replaced it. This enabled the jacks to be inserted bearing on these rings to widen the gap between the pipes. Usually the cutter operator telephoned the intermediate jacking-station operator when to jack forward the leading string of pipes and when to stop. The intermediate operator then used the forward jacking station to push this string forward as instructed.

The average rate of progress was about 5 ft. in an 8-hr. shift or 15 ft. a day with an 8–10-man crew; work continued seven days a week. Jacking was almost continuous, and the installation of each new section of pipe took 30–60 min.

Pipe-line lubricating system

This progress was made possible only by the external lubrication of the pipes. The lubricant was injected at the cutting edge and also as the pipe entered the tunnel. Following lubricating points were established, the first 65 ft. from the jacking-pit where a 3-ft. dia. hole was drilled over the pipe to serve as a reservoir. Lubricating inserts were provided at intervals along the pipe-line in holes drilled through the pipe-walls for pressure lubrication; lubricant was forced in while each additional pipe-joint was being made in the jacking-pit.

To prevent damage to the pipe-ends during jacking they were made specially smooth, the spigot-end being hand-finished. A ring of asbestos insulating material was applied to the inside of the socket-end, this material having a compressive strength and resilience to take up irregularities in the concrete end surfaces under the 1,200-lb. per sq. in. end-pressure applied by the jacks.

The work was completed by Johnson Western Constructors of San Pedro, California, in 80 days.

DIESEL-HYDRAULIC SHUNTING LOCOMOTIVES for Victorian Railways

At lower capital cost, the units provide same horsepower as diesel-electrics for shunting work

THE latest addition to the Victorian Railways' fleet of diesel locomotives is the "W" class diesel-hydraulic shunting locomotive.

Following an order for 25 locomotives at a cost of over £1 million, the type has been introduced progressively from the end of 1959.

These units are being used for suburban goods services, main-line transfers and livestock movements between marshalling yards. They are rapidly replacing the majority of steam locomotives working in the Melbourne area.

Some time ago, two 150-h.p. diesel-hydraulic shunting locomotives were constructed at the Newport Workshops for use in that area. Apart from these, the "W" class is the first fleet to have diesel-hydraulic transmission in Victoria.

For the same horsepower, diesel-hydraulic units have been found to involve a lower capital cost than diesel-electric locomotives for shunting work.

Of 650 h.p. and 0–6–0 type, they were designed and built by Tulloch Limited a New South Wales manufacturer. The design incorporates a 12-cylinder Mercedes Benz diesel engine, Krupp two-stage hydraulic transmission and axle-gear, and Behr hydrostatic cooling equipment. They are similar to the V. 60 type of locomotive.

Some details of the "W" class are:—

Length	...	25 ft. 6 in.
Width overall	...	9 ft. 7 in.
Height overall	...	13 ft. 3 in.
Wheel base	...	12 ft. 6 in.
Wheel dia.	...	48½ in.
Tractive effort (starting)	...	26,880 lb.
Maximum speed	...	40 m.p.h.
Weight	...	48 tons

A funicular railway

Concluded from page 705

The wagon body is quickly detachable from the underframe and this is particularly useful for the rapid transfer of loaded wagon bodies from the main line to goods sidings at the terminal stations as well as their transfer between the two sections of main line.

Passengers carried on the railway in 1960 totalled 388,097.

As the Hill Railway is too small to have its own full-time manager and engineer, the day-to-day operation, maintenance and administration has, since the completion of construction, been in the care of the George Town City Electricity Supply Department, which has adequate facilities available.

The Penang Hill Railway is owned by the Government of the State of Penang which controls all matters of policy in connection with the undertaking.

HIGH-PERFORMANCE LIGHTWEIGHT TRAINS
diesel and electric

Features of design and operation to obtain maximum benefits from diesel and electric traction

(by a correspondent)

TO COMPETE with the private car on a 100-mile journey, a main line train will soon have to average 75 m.p.h. inclusive of several stops (1). Feeder services must also be good; their withdrawal produces little direct financial saving (2) and results in many passengers making the whole journey by road.

Rapid acceleration up to high speed after station stops and signal and permanent way checks is axiomatic for all such services and can be attained economically only by lightweight trains. Multiple-unit sets are inherently better in this respect than locomotive-hauled trains (3), and also possess other well-known advantages. Any faults they tend to have are not inherent and by proper attention during design it should be possible to eliminate them.

The surprisingly large benefits obtainable by the use of lightweight trains are quantified in Fig. 1. The lines curving upwards to the right show the horsepowers necessary to give various rates of acceleration to two "crush-loaded" multiple-unit sets at various speeds.

Horse-power comparison

Both sets are of four cars, the conventional one being an existing set of 152 tons tare weight (dotted lines), whilst the other is partially streamlined and, far more important, weighs only 118 tons (full lines).

It will be seen that the light train's advantage increases with speed. If, for example, 1,200 h.p. is assumed to be available, the position of point A relative to the dotted lines shows that the conventional train's acceleration at 79 m.p.h. will be ·13 m.p.h./sec., compared with the lightweight train's ·20 m.p.h./sec. (full lines). This improvement (54 per cent) is double that obtained at 35 m.p.h., where point B corresponds to ·76 m.p.h./sec. for the lightweight train and ·60 m.p.h./sec. for the conventional one.

The horsepower values quoted above

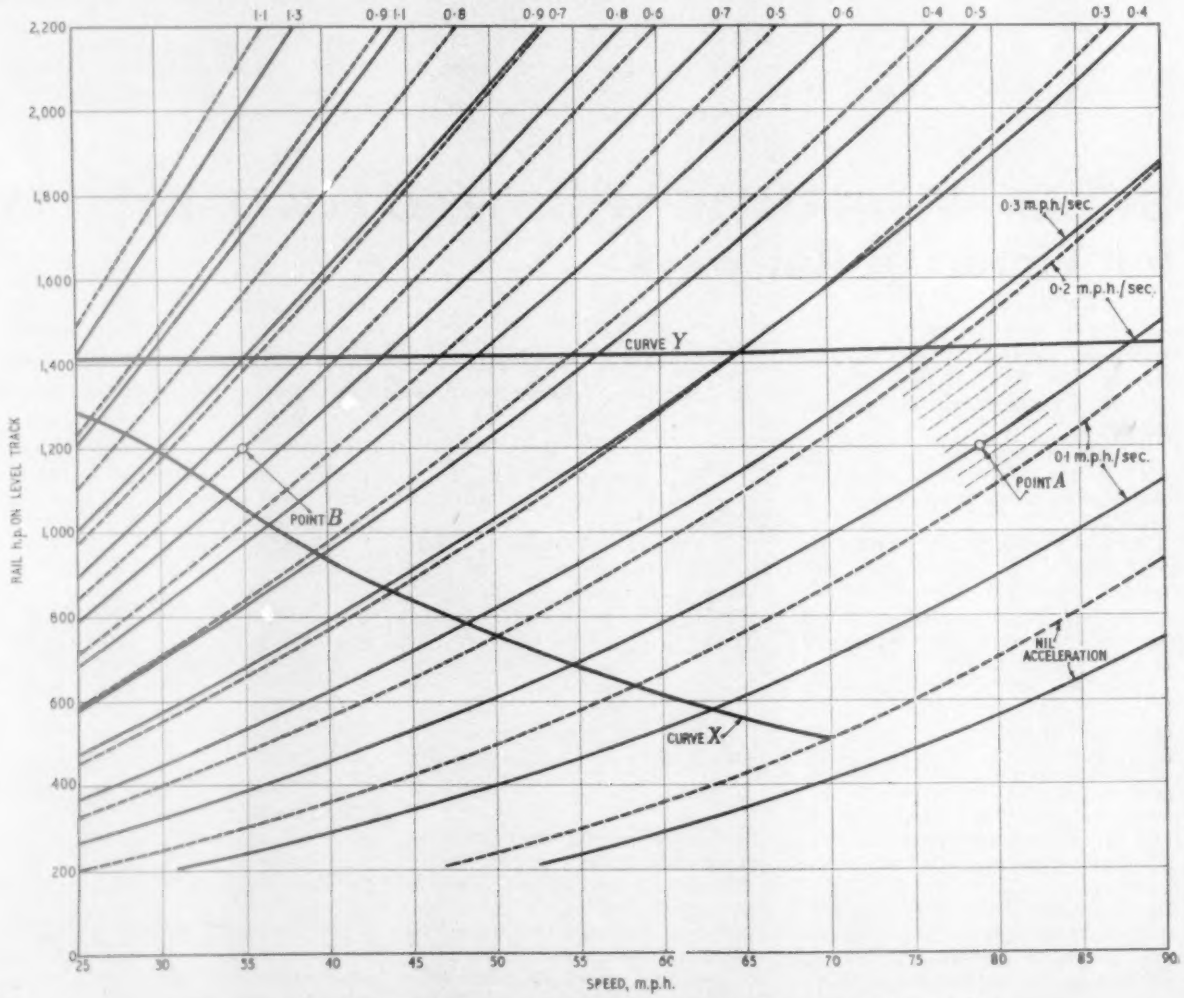
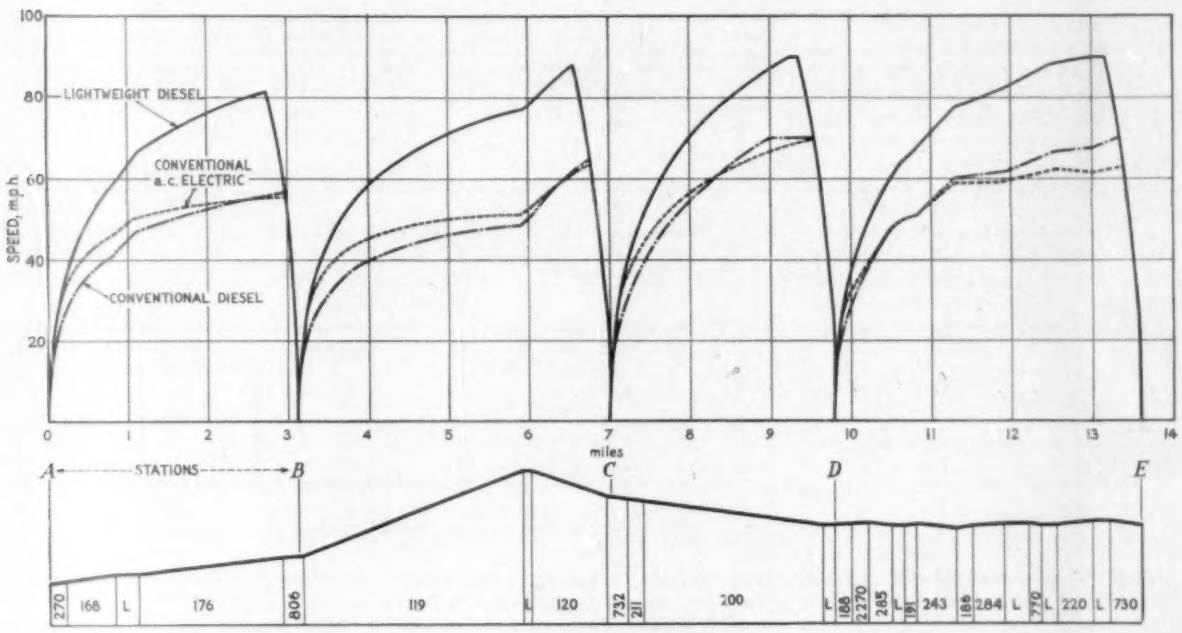


Fig. 1—relationship between power, speed, and acceleration for four-car multiple-unit trains



Type of set	Tare weight	Total weight with 32 ton "crush" load	Horse-power	Minimum running time (derived from above speed curves)					Recovery time (7 per cent of previous column)	Station time (4 x 30 sec.)	Schedule time (total of three preceding columns, i.e. "start-to-start" time)
				A-B	B-C	C-D	D-E	Total			
	tons	tons		min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.	min. sec.
Lightweight diesel ..	118	150	1920	3 48	4 32	3 18	4 9	15 47	1 6	2 0	18 53
Conventional a.c. electric	152	184	variable	4 28	5 33	3 43	4 45	18 29	1 18	2 0	21 47
Conventional diesel ...	138	170	952	4 54	6 5	3 53	5 7	19 59	1 24	2 0	23 23

Fig. 2—comparative performances of four-car multiple-unit trains on stopping service

refer not to the output of the diesel engine(s) or electric motors, but to the power which actually reaches the wheel-rims, termed the rail h.p. The published h.p. is much less significant; it is particularly misleading to compare the figures for electric multiple-units and locomotives with their diesel counterparts, for two reasons. First, all but 2 per cent of the electric motors' output reaches the wheel-rims, but the rail h.p. of a diesel can be as much as 22 per cent less than the actual engine horsepower, depending on the conditions and type of transmission.

Power output

The second reason is that in contrast to the substantially constant horsepower of a diesel engine, the output of the motors of an electric train usually drops considerably as speed rises. Curve X in Fig. 1 is typical; though rated as nominally 830 h.p. (the so-called continuous rating), the actual output rises to a momentary peak of 1,290 rail h.p. at 25 m.p.h., but has fallen to only 505 rail h.p. at 70 m.p.h.

As shown later, it is quite feasible to fit two diesel engines totalling 1,920 h.p. in the lightweight set; the resulting rail h.p., shown by Curve Y, would give it a performance well in advance of any train in this country.

Though such graphs have considerable technical significance, the final issue is the resulting reduction in running time. Fig. 2 compares the speeds and timings of three four-car multiple-unit sets over a fictitious route. The lightweight diesel has already been mentioned; the second is a conventional a.c. electric and the third a conventional diesel set with four engines.

Recovery margin

To promote punctuality, the schedules shown for all three trains allow a 7 per cent time margin even under the worst conditions of loading. The resulting 43·2 m.p.h. overall speed of the lightweight diesel train is high for such circumstances; many existing Type 2 diesel locomotives—even if geared for 90 m.p.h.—could only maintain this timing if running light.

The lightweight train's scheduled speed could be raised to 50·4 m.p.h. by limiting the number of standing passengers and allowing 15 sec. for most stops. Its capabilities are shown to more advantage on semi-fast services, where a 75 m.p.h. overall schedule (again including 7 per cent margin) would be possible on most routes without exceeding 90 m.p.h., provided that few stops are under 45 miles apart.

Electric traction is theoretically far superior in combining high power with light weight and small bulk. The motor car in Fig. 3 is therefore shown with diesel power equipment as being more difficult to accommodate; if built for electric traction advantage would be taken of the smaller body space required, other features remaining unaltered.

Power equipment

Provided that it is light and compact, a single engine should be greatly superior to several small ones developing the same total power. The one shown in Fig. 3 is rated at 960 h.p. and drives both axles of one bogie through hydraulic transmission; the heavier items are positioned so as to increase the adhesion load, thus saving the extra weight and cost of spreading the drive over two more axles. Using only well-proved components, the complete diesel power equipment adds 14 tons (including 300 gals. fuel) to the 22 tons basic weight of a trailer car. Suitable resilient mountings for the engine are available to keep the body completely free from vibration.

Articulation produces worthwhile weight-saving only if car bodies do not have to be shortened to keep within the loading gauge on curves. Solutions to this and other problems peculiar to articulation are known, but as these are not considered in this article the car in Fig. 3 is shown without this feature.

It is usual in passenger vehicles to employ a separate body and underframe.

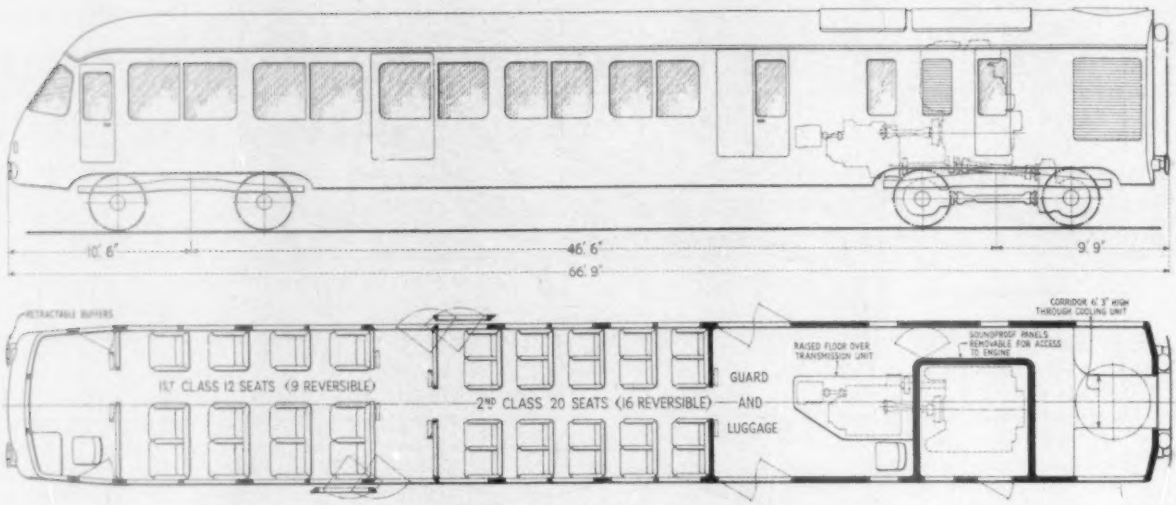

10' 6"
46' 6"
9' 9"
66' 9"
RETRACTABLE BUFFERS
CORRIDOR 6' 3" HIGH THROUGH COOLING UNIT
RAISED FLOOR OVER TRANSMISSION UNIT
SOUNDPROOF PANELS REMOVABLE FOR ACCESS TO ENGINE
1ST CLASS 12 SEATS (9 REVERSIBLE)
2ND CLASS 20 SEATS (16 REVERSIBLE)
GUARD AND LUGGAGE

Fig. 3—express and semi-fast lightweight diesel motor coach

Though the latter is designed to support the whole of the vertical load without assistance from the body, it is impossible in practice to prevent the body from carrying nearly half. Considerable weight can therefore be saved by designing the body as an integral load-carrying structure without any form of underframe.

Aspects of design

Several other aspects of body design remain to be considered. The stagecoach type of door, besides having other disadvantages, wastes much time when a large number have to be closed by platform staff. Power-operated doors need not be open unnecessarily if operated by individual push-button and arranged to close automatically whenever possible without awaiting the guard's over-riding control. To promote cleanliness, all surfaces should be without ledges and joint strips; corners should be well-rounded. Opening windows are difficult to clean and out of place in a modern vehicle; plain double glazed windows, besides improving heat and sound insulation, allow the glass to be flush with the panelling both inside and outside the car. Pressurised ventilation promotes rapid warming up from cold and, by the addition of filters, gives results in this country almost indistinguishable from full air conditioning.

Gangway access throughout the train is essential on longer-distance services and desirable on suburban lines, where the increased productivity of the travelling ticket collectors should soon cover the extra cost. Likely improvements to the connections between the cars of a set are suggested by the standard German Bundesbahn design, but a new conception is needed for use between sets, for when not in use it must match the streamlined end of the car and not impede the passengers' view.

A smooth exterior, without ledges or ventilator vanes, will assist external cleanliness by ensuring the best results from vertical-spindle washing machines; under normal conditions each train should be so washed two or three times daily.

It is pointless to build new vehicles that do not give superlative riding. A cup of tea provides a more exacting test than a threepenny bit stood on edge; the tea should not spill even when filled to rim-level and its surface should be free from the ripples that denote vibration. Multiple-unit propulsion and light-weight cars are factors which in the past have often led to bad riding, but there appears to be no basic reason for this to continue (4). The present brake apparatus is not only noisy and harsh in operation, but observation from a glass-fronted railcar shows that its response to the driver's actions is often inconsistent. Any desired degree of braking should automatically be obtained by moving the driver's brake valve handle to the corresponding angular position. Disc brakes have an inherently sweet action and should need far less maintenance than the best conventional types. Dynamic braking may be a worthwhile addition.

Rapid replacement

Every component of a car should be designed for rapid replacement; instead of having to be out of service for at least 10 hours for, say, tyre-turning or a major engine inspection, the set should be running again after two hours with a replacement bogie or engine.

In contrast to the 13 widely differing designs of multiple-unit sets in current production, all future requirements, except railbuses, should be covered by one basic design slightly varied to suit d.c., a.c., or diesel propulsion. Excepting such vehicles as refreshment cars, only two body versions (including seating) are needed to cover all services; regional variations should be restricted to interior decoration.

Apart from greatly easing the burden on the operating and maintenance staff, this rigid standardisation is the only way to ensure the expeditious production of reliable up-to-date rolling stock. Designing a unit that will not be obsolete in 10 years can never be an entirely predictable process and there is no substitute for intensive and intelligent testing. Lengthy trial operation in service is not enough, the prototypes must also endure a simulation of the worst combination of conditions to be met.

Maximum performance

For maximum performance (as in Fig. 2) half the train must consist of motor cars, but many services could be adequately worked with a ratio of two or even three trailers per motor car.

At least in the case of the diesel, the power equipment should prove equally suitable for express or stopping services, thus allowing complete interchangeability of all cars to cover changing traffic conditions. To permit rapid alteration to train formation, automatic couplings can be justified at the cab end of motor cars; elsewhere it is sufficient for the couplings to permit a car to be added or removed in five minutes.

A fast, frequent and reliable interval service not only appeals most to the public, but also makes the maximum use of staff and equipment. The new sets should only cover the basic interval service; their number need then be approximately half that required for peak demand. Peak hour extras can be formed of older stock and, to enable them to run on stopping services without delay to following lightweight trains, they can be speeded up by the judicious elimination of two or three station stops.

By reason of their light weight, low centre of gravity and superior riding,

4-CAR SETS ON STOPPING SERVICE

	Conventional	Lightweight
First cost—motor car	£20,000	£36,000
First cost—trailer car	£12,000	£15,000
First cost—4 car set (2 motor + 2 trailer cars)	£64,000	£102,000
Annual mileage	60,000	120,000
	Cost in pence per mile	
Capital charges { 6 per cent interest	15·4	12·2
Capital charges { depreciation on 25 year life	10·2	8·2
Maintenance (2 x 4·0d., plus 4 x 1·7d.)*	14·8	14·8
Servicing, cleaning, etc. (4 x 1·1d.)*	4·4	4·4
Fuel (derived from Fig. 2 but with some coasting as when not regaining time)	9·5	13·5
Crew (110 miles/day conventional ; 130 miles/day light-weight)	10·9	9·2
Total cost of providing service	65·2	62·3

* Derived from (5).

the speed restrictions applicable to the new trains should be from five to 25 m.p.h. higher than the current ones. All routes—even London-Scotland—should be served by at least one train an hour; inter-city and suburban lines need at least two an hour. Times should be completely standardised—the present occasional variations confuse passengers and staff alike.

Punctuality

Assuming reliable equipment and a realistic timetable, punctuality depends mainly on the driver. Passengers in glass-fronted railcars often note how frequently the style of driving remains quite unaltered though the train is late. Full co-operation from all drivers in endeavouring to make up for the inevitable signal and other delays can only be ensured by a direct financial incentive. Adequate safety measures must be present, but need be no more than would be given by a proper form of automatic train control. A moving paper roll would also record the happenings during the run as is now done abroad, the whole apparatus being viewed by the driver as substantiating his claims as to signal checks received and proving that he regained time without taking risks.

It should be possible to build up in the public mind the idea that any station is the gateway to an interconnecting network of fast, frequent, punctual and supremely comfortable trains. The basic interval service could doubtless be shown in the form of a pocket map covering the whole system, a normal timetable only being needed to include the extra services.

These methods should allow the new trains to be operated at no greater cost than existing ones. The table compares the totals in pence per mile for the two diesel trains scheduled in Fig. 2. Some of the costs shown for the conventional set actually refer to another type (5), but do not invalidate the comparison. A like table for electric trains would give totals very similar to those for the diesel units.

REFERENCES

1. G. F. Fiennes, "Future Developments in Passenger Travel," read before the Railway Students Association, November 25, 1959.
2. Central Transport Consultative Committee Report for 1960.
3. "Alternatives in the Utilisation of Diesel Power," Diesel Railway Traction, January 1950.
4. "Obtaining a Smooth-running Bogie," "*The Railway Gazette*," January 6 and 20, 1961.
5. W. J. A. Sykes, "Operating Experiences with the Diesel-Electric Train Sets on the Hastings Service of the Southern Region," read before the Institution of Locomotive Engineers, October 18, 1960.

MECHANICAL EQUIPMENT for track work

Progressive introduction of power tools and equipment on the New Zealand Government Railways

Standard motor trolley

DURING the past ten years the Way & Works Branch of New Zealand Railways has considerably extended its use of mechanised equipment and labour-saving devices. Power tools and equipment are steadily being introduced for all operations in which their use is economic. Generally the practice is to concentrate their use in the hands of special gangs. They are associated with the laying of new track, or with track renewals, rather than with ordinary track maintenance.

Pneumatic equipment in use includes woodborers, impact wrenches (for screw-spikes), fishbolt wrenches, and rail drills. These are driven from compressors able to supply 60 cu. ft. a minute.

Rail-drilling machine

For surfacing the track, power jacks and two Matisa ballast tamping machines have been acquired. The measured shovel-packing system has also been adopted as standard practice. Other track equipment purchased includes sleeper-adzing machines and Thermit rail-welding equipment. Three flash-butt rail-welding depots have been established. A Matisa track-recording trolley is in use.

For bridgework, in addition to the usual compressors and air tools, pneumatic-powered staging, a steam pile-hammer, and diesel-driven winches have been acquired in recent years.

More excavating equipment

Mechanical equipment in use is completed by excavators, bulldozers, loaders, graders, and motor trolleys. The number of items of this class of machinery is steadily being increased.

Eventually, all the manual velocipedes will be replaced by motor trolleys. A lightweight two-man machine has been standardised for general use, but four-man and six-man machines are available. These have made work less laborious and have effected economies in time and labour.

MODERNISED REFRESHMENT ROOMS at Brighton Station

Air-conditioned accommodation for 60 persons provided in contemporary style

THE British Transport Hotels and Catering Services has completed modernisation of Brighton Station refreshment rooms. The station now has one of the most up-to-date light catering facilities on the South Coast lines.

The refreshment rooms were taken over from private contractors in 1952, and two years later they were partially modernised by the provision of a cafeteria, buffet, and lounge bar. The latest scheme involved the removal of the kitchen from the first floor to the rear of the cafeteria on the ground floor, thus providing a more efficient service.

Party catering

The former kitchen has been converted to a dining room with dispense bar and cloakrooms. This room has been designed to cater for parties. The former dining room on the ground floor has been converted into a store for station trolleys and for general service purposes. The cafeteria, buffet bar, lounge, and staff rooms have been renovated.

The refreshment rooms thus comprise three sections with the main part forming the cafeteria, which has seating accommodation for 60 persons. It is in contemporary style with a suspended ceiling. The rooms are air-conditioned.

A similar décor has been followed in the buffet bar and lounge which has direct access from the cafeteria. The licensed bar is equipped with refrigerated shelving.

Entrance to cafeteria at Brighton Station refreshment rooms

The general contractors for the scheme were R. W. Bowman Limited. The work has been carried out under the direction of Mr. S. P. Smith, Chief Works Officer, British Transport Hotels & Catering Services. The decorative consultant was Mr. John Hill of Green & Abbott Limited.

The refreshment room, showing lighting, décor, and seating accommodation

Other refreshment improvements

Under its modernisation programme, British Transport Hotels & Catering Services has carried out improvements at over 40 per cent of the stations where it provides the catering, including a number on the South Coast. As well as Brighton, modernisation has been carried out at Southampton, Portsmouth and Southsea, Hastings, Chichester, Worthing, and Lewes.

The principal sub-contractors and suppliers were as follow:—

Suspended ceiling ...	Expanded Metal Co. Ltd.
Wall tiling	Carter Tiles Limited
Air conditioning ...	Heating & Ventilating (Southern) Limited
Bottle cooling ...	Lightfoot Refrigeration Co. Ltd.
Light fittings ...	Maple & Co. Ltd.; Metal & Arts Co. Ltd.; Courtney Pope (Electrical) Limited
Wallpaper	H. A. Percheron Limited
Tables and seating in cafeteria	Pel Limited
Chairs for buffet ...	Tecta Furniture Limited
Tables for lounge ...	John I. Brooke Limited
Chairs for bar/lounge	Finmar Limited
Floor covering service area and dispense bar	Semtex Limited

PERSONAL

British Transport Commission

MR. T. A. GERMAINE, O.B.E., Assistant Public Relations Officer, British Railways, Eastern Region, who, as recorded in our June 16 issue, has been appointed Assistant Public Relations Officer, British Transport Commission, in charge of internal relations and public correspondence, was educated at the City of London School, and joined the L.N.E.R. in 1930 in the Locomotive Running Department. After employment in both the General and Engine Diagramming Sections, he transferred to the Passenger Department. In 1938, Mr. Germaine was

Mr. T. A. Germaine

transferred to the General Manager's Office, Kings Cross, on Wages Staff duties. Mr. Germaine joined the Artists' Rifles in 1934, and he was commissioned on the outbreak of war. He returned to the railways in 1946, and became Public Relations Representative, General Manager's Department, in Manchester. In 1948, he was appointed to the Regional Establishment & Staff Officer's Department in London, and was appointed Public Relations Assistant, Eastern Region, six months later. He was appointed Assistant Public Relations Officer last year.

Industrial

SIR PETER ROBERTS, M.P., MR. F. H. BROOKS, LORD RIVERDALE, SIR ROBERT ADEANE and MR. K. E. WALKER, have been appointed to the board of Hadfields Limited.

MR. T. B. ELLIS, Secretary, General Electric Co. Ltd., is to retire. He will be succeeded by MR. A. M. PARSONS. MR. C. S. P. MALLAM has been appointed Controller and MR. B. E. DAVEY has been appointed Chief Accountant.

MR. H. A. SIEPMANN has resigned from the board of North British Locomotive Co. Ltd.

MR. J. SCOTT has been appointed a Director of Thermotank Limited, a member of the Hall-Thermotank group of companies.

MR. S. W. PERKINS, Director, Wickman Limited, has been appointed to the board of the Gisholt Machine Co. (Great Britain), Ltd.

MR. A. H. CAMPBELL, Director & General Manager, Hilger & Watts Limited, has been appointed Joint Managing Director with MR. G. A. WHIPPLE.

SIR EDWARD PLAYFAIR has been appointed Chairman of International Computors & Tabulators Limited, with effect from August 1 when he will be released from his present position as Permanent Secretary to the Minister of Defence.

British Railways

MR. R. E. EVANS, District Engineer, Ipswich, British Railways, Eastern Region, has been appointed District Engineer, Stratford.

MR. C. S. COCKS, Mechanical & Electrical Engineer (Development), Chief Mechanical & Electrical Engineer's Department, Derby, British Railways, London Midland Region, is to retire on June 30.

MR. G. R. DANSKIN, Stationmaster, Rowlands Gill, British Railways, North Eastern Region, has been appointed Stationmaster, South Gosforth, also in charge of West Jesmond.

MR. A. R. CRIGHTON, Assistant to the Running & Maintenance Officer, H.Q. Organisation, Glasgow, British Railways, Scottish Region, has been appointed District Running & Maintenance Engineer, Perth.

MR. R. B. REID, Assistant District Goods Manager, Glasgow, British Railways, Scottish Region, has been appointed District Passenger Manager, Glasgow & South West Division.

MR. R. T. JAMES, Area Materials Inspector, Glasgow, Scottish Region, British Railways, has been appointed Materials Inspection Officer, Derby, British Railways Central Staff, Mechanical Engineering Department, British Transport Commission.

MR. T. FISKE, A.M.INST.T., Principal Assistant to the General Manager, London Midland Region, British Railways, who, as recorded in our June 16 issue, has retired, joined the London & North Western Railway on leaving St. Paul's School in 1920. After training at goods depots in the London District and at Nuneaton Control, he served at a number of goods depots in Birmingham and South Staffordshire and in the offices of the District Goods Managers at Wolverhampton, Northampton, and Broad Street. He was subsequently appointed to the newly-formed Station Working Section of the Goods Operating Manager at Euston. After reorganisation of the L.M.S. Railway in 1927, Mr. Fiske was transferred to the staff of the Vice-President for Railway Traffic Operating & Commercial, becoming Secretary of the L.M.S. Main Line Electrification Committee and being associated with the Post-War Development Committee. In the last two years before nationalisation he was also Secretary of the Traffic Committee of the L.M.S. Board. On nationalisation, Mr. Fiske was appointed an Assistant in the Headquarters office at Euston and, in 1950, became Assistant (Works & Equipment) to

Mr. T. Fiske

the Chief Regional Officer. He became Assistant to the General Manager (Modernisation) in 1955, and Principal Assistant in 1959.

MR. W. R. BATTY, Head of Passenger Trains Section, Traffic Headquarters, York, British Railways, North Eastern Region, retired on June 17.

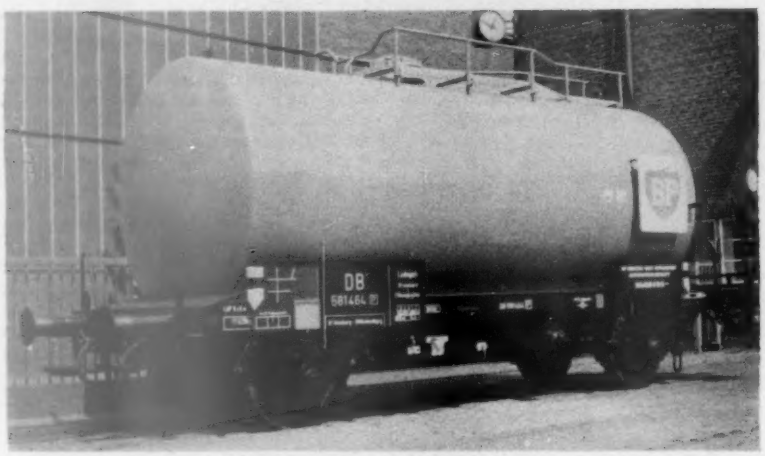
Permanent Way Institution

MR. HORACE JANES, Hon. Secretary of the Permanent Way Institution has relinquished that position. MR. J. A. R. TURNER has been elected Hon. Secretary in his place.

Public Transport Association

MR. A. F. R. CARLING, Chairman of the Public Transport Association, has relinquished that position. MR. R. J. ELLERY has been elected Chairman, and MR. F. W. HODGKINSON and MR. W. M. DRAVERS have been elected Vice-Chairmen.

NEW EQUIPMENT *and Processes*



ANGLE CUTTER

To cut Dexion slotted angle the maker has produced the Mark V cutter.

This requires no assembly and may be used on bench or floor. It is easily portable.

The cutter works on the guillotine principle, enabling clean cuts, including diagonal ones, to be made easily.

Additional information is obtainable from the Dexion Group, Maygrove Road, London, N.W.6.

AUTOMATIC LADLING

A radiant dome aluminium-holding furnace, fitted with a Lindberg Autoladle, has recently been put into use. The Autoladle makes fully automatic die-casting possible by dispensing accurate amounts of metal at regular intervals, to a heated launder, for delivery to gravity or pressure die-casting machine. The holding furnace is of American design and is now manufactured in this country.

The furnace, which has a capacity of 2,000 lb., has separate charging and ladling wells; the division between them prevents inclusions from the melting furnace getting into the ladling chamber. The metal is maintained at the required temperature by radiation from non-metallic Globar elements, mounted horizontally above the surface of the metal and easily withdrawn from the side of the furnace. The temperature of the aluminium is controlled automatically.

The Autoladle is submerged in the ladling well and withdraws aluminium from below the surface. It is operated by air-pressure; the quantity of metal it dispenses depends upon the amount of pressure and its duration, and remains constant regardless of the level of the metal. It discharges any quantity of aluminium up to 15 lb. at one minute intervals. Larger models can handle weights up to 60 lb. The holding furnace is made with capacities down to 300 lb.

Additional particulars are available from Foundry & Metallurgical Equipment Co. Ltd., Queens Road, Weybridge, Surrey.

LIGHTWEIGHT WAGON

Unusual construction has resulted in the attainment of an exceptional tare/weight ratio, despite the fact that no light alloys have been used. The buffing and brake gear moreover comply with the latest U.I.C. specification.

The wagon illustrated has hollow solebars, one side of the box section being formed from the shell of the tank, as shown in the sectional drawing. This has resulted in a frame capable of withstanding shocks of up to 150 *tonnes* a buffer, a claim substantiated by tests carried out by the Central Research Department of the German State Railways.

The tank capacity is 36 cu. m. (47 cu. yd.) and the tare weight 11·6 *tonnes* (11 tons 6 cwt.).

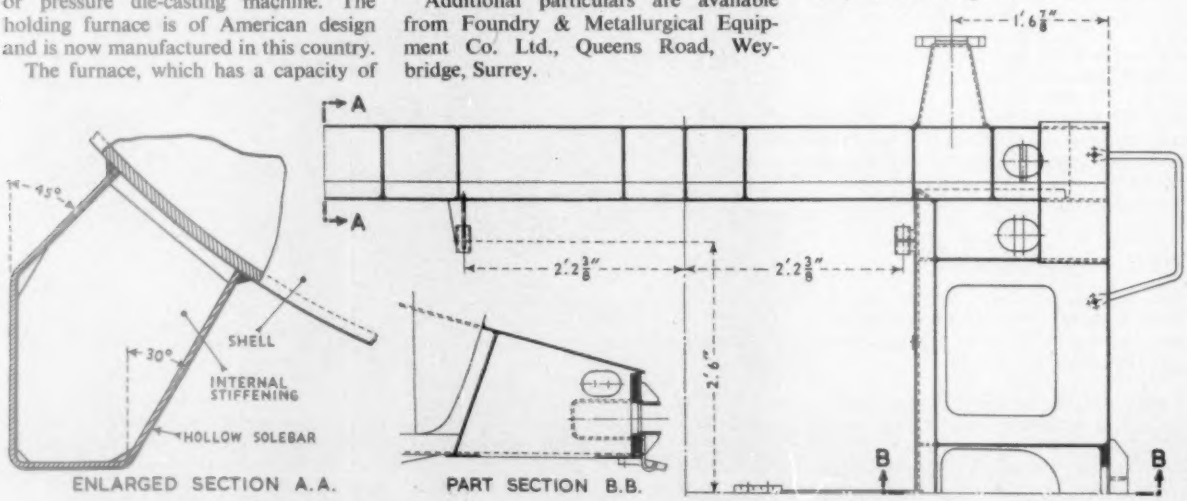
Full particulars are available from the builder, Rheinstahl Siegener Eisenbahnbedarf, (21b) Dreis-Tiefenbach, Kreis Siegen 1.W. Germany.

PLASTIC LINING

Polytile type BL has been introduced to give a clean, hygienic, washable lining with good resistance to water, chemicals and solvents and high resistance to abrasion. It is easily applied by brush, roller or spray-gun to the interior surfaces of silos, bins, hoppers and the like, made of steel, concrete, wood or other normal constructional materials.

In addition to good abrasion resistance, it is reported that trials over a wide field have shown this material to have remarkable release properties, that is, materials do not stick to it.

Full information is obtainable from Corrosion Limited, Warsash Road, Warsash, nr. Southampton.



DUMPER-TRAILER

Robert Hudson, Ltd., has introduced the hydraulically-operated 7 cu. yd. "Leedsall" dumper-trailer. This consists of a Fordson prime mover, or similar tractor, combined with a Hudson-built rear-dumping trailer.

Compared with truck-type dumpers of the same capacity, the dumper-trailer is claimed to provide a considerable saving in capital, running, and maintenance costs. Maximum tractive effort is achieved on the driving wheels of the tractor and front axle and the steering is stable, loaded or empty.

The prime mover and dumper-trailer are coupled together by a drawbar linkage which permits complete articulation in all directions with a more than 90 deg. swing on either lock. The drawbar arrangement allows the tractor-trailer combination to articulate without lessening the individual stability of either unit and gives a turning circle of less than 30 ft.

The rated capacity of the Leedsall is 20,000 lb. and wet sand and gravel have been carried with recorded loads of up to 10 tons 7 cwt.

The body shape has a high sheer and eliminates the necessity for fixtures or side boards when a maximum load is being carried. The body is in heavy-gauge steel plate fabricated with reinforcement angles for rock-carrying duties and welded throughout.

Full particulars may be obtained from the United Kingdom distributors, Blackwood Hodge & Co. Ltd., 25 Berkeley Square, London, W.1. Overseas readers should make application to Robert Hudson Limited, Raletrux House, Meadow Lane, Leeds, 11.

MAGNET VALVE

A new magnet valve has been produced for use with pneumatic devices on diesel-electric locomotives.

This valve has an encapsulated coil, which is said to resist mechanical damage and eliminate failures due to dirt, moisture or oil. A further feature is a metal seal which will, it is claimed, go up to six years without inspection or cleaning. The valve has relatively few parts, a factor making for reliability and reduced maintenance.

The maker states that the electrical design of the valve prevents overloading of circuit relays.

Additional particulars are available from the General Electric Company, Schenectardy 5, N.Y., U.S.A.

AIR COMPRESSOR

The latest addition to the Bristol range of airflow-cooled compressors is a compact two-wheel trailer-mounted compressor, designed for easy manœuvrability and high-speed towing.

The new Model 271 two-cylinder two-stage Compressor has a guaranteed output of 215 c.f.m. free air delivery to B.S.S. 726.

Both stages of compression are carried out in different parts of each cylinder by means of a truncated double-acting piston, thus providing large cooling surfaces to the high-pressure cylinders, which are effectively cooled by air blast from the intercooler fan. The maker claims advantages which include high output, maximum fuel and power economy, small bulk and low weight.

Power is obtained from a Fordson six-cylinder diesel engine, providing 64 b.h.p. at 1,400 r.p.m., controlled by a pneumatic speed governor.

The two-cylinder 90 deg. V. air compressor is coupled as an integral unit with the engine and is driven through an automatic centrifugal clutch. Large-capacity low-lift cushioned valves are controlled by a pilot unloader and a time-lag device permits the engine to regain full running speed before the air compressor again comes on load.

Further information is obtainable from Bristol Pneumatic Tools Limited, Causeway Works, Fishponds, Bristol.

TUBE PROFILER

The "Tubefile" has been produced to flame cut profiles on steel tubes which are required to saddle other tubes. The design permits the machine's use also in the profiling of steel pipes for the chemical and petroleum refining industries.

The use of this machine enables the preparatory processes, associated with hand-held flame cutting equipment, to be eliminated. From a simple drawing, giving centre-line information, profiles can, it is claimed, be cut on each tube using unskilled labour.

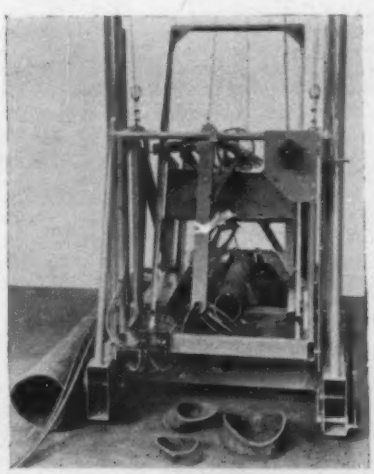
Multiple profiles, resulting from the intersection of several tubes, can also be produced.

Tubes up to 18 in. external dia. can be handled. While there is no theoretical lower limit, it would not be economic to profile tubes much below 4 in. dia. There is a practical lower limit of 6 in. on the barrel dia. for which the profile is being cut.

The lower limit of the angle between barrel and branch is 30 deg. This represents no limitation in practice, particularly for structural work.

The accuracy of the profile in the worst case is better than $\frac{1}{32}$ in., and on the average is about $\frac{1}{64}$ in. The only finish required is the removal by chipping hammer of a small amount of slag formed on the cut edge of the bore.

Additional information is obtainable from General Precision Systems Limited, Bicester Road, Aylesbury, Bucks.



Ministry of Transport Accident Report

Second interim report on the accidents and failures which occurred in multiple-unit electric trains in the Scottish Region and Eastern Region, British Railways

The second interim report issued by Brigadier C. A. Langley, Chief Inspecting Officer of Railways, Ministry of Transport, on the accidents on December 13 and 17, 1960, in multiple-unit electric trains on the Glasgow suburban electric service, and on all other relevant accidents, failures, and troubles experienced in the operation of these services and of those on the other high-voltage a.c. overhead electrification systems of British Railways is summarised below. Brigadier Langley was greatly assisted by the officers and engineers of the British Transport Commission and the Eastern and Scottish Regions; by the contractors, the General Electric Co. Ltd., and Associated Electrical Industries; and by the British Transport Commission's Consulting Engineers. With reference to the last, Mr. F. J. Lane, a partner of Messrs. Preece, Cardew & Rider, has been investigating the failure of transformers. Mr. E. L. E. Wheatcroft and Mr. T. W. Wilcox, partners of Messrs. Merz & McLellan, have been investigating the failure of traction motors, rectifiers, and associated equipment in the G.E.C. multiple-units.

Brigadier Langley's first interim report was issued last January* and dealt mainly with the Glasgow failures. This second interim report is concerned mainly with the failures of the G.E.C. units on the Eastern Region's recently electrified North-East London suburban lines, to see whether they were in any way connected with those in the Scottish Region.

The Eastern Region service

The report stated that the Eastern Region service dealt with, comprised the lines from Liverpool Street to Bishops Stortford via the Churchbury Loop, with branches from Hackney Downs to Chingford, Bury Street Junction to Enfield Town, and Broxbourne Junction to Hertford East. The overhead conductors from Liverpool Street to Cheshunt just short of Broxbourne on the Bishops Stortford line, and also those on the Enfield and Chingford branches, were energised at 6·25 kV. From Cheshunt onwards to Bishops Stortford and Hertford East they were energised at 25 kV.

Conditions on the North-East London suburban lines differed widely; those on the Chingford and Enfield lines, especially the latter, were severe. They had sharp curvature and steep gradients. The distances between stations were short, averaging only one mile.

The G.E.C. fleet comprised 52 three-car units and 19 four-car units. The three-car unit consisted of driving trailers at the ends with a motor coach in the middle. A composite non-driving trailer was added to make up a four-car unit. Each motor coach was powered by four motors, one on each axle, and it carried the pantograph mounted above the guard's van.

*See *The Railway Gazette*, January 20, 1961

Path of current

The current from the overhead conductor was collected by the pantograph, and then passed through an air-blast circuit-breaker on the roof. This was of the Brown-Boveri type, and comprised an arc extinction chamber and an isolating switch. It was very rapid in its action, and the primary over-voltages were governed by the combined characteristics of the circuit that was being opened and the shunting resistance. The maximum voltages are substantially the same whether operating on 25 kV. or 6·25 kV.

From the circuit-breaker the current passed through a heavily-insulated cable to a voltage change-over switch which connected the four sections of the transformer primary winding in series for 25-kV. operation or in parallel for 6·25-kV. operation. The return current was fed to the wheels through brushes on each axle of the motor coach.

The transformer had a rating of 1,000 kVA. and could take current through the primary winding at either 25 kV. or 6·25 kV. The secondary winding had a rated voltage of 1,875 V., and there was a tertiary winding for the supply of auxiliaries at 270 V. The motor voltage was controlled by tapping switches on the transformer secondary. The earth connection in the motor circuit was then at the mid-point of the transformer secondary.

The transformer secondary winding supplied current to two circuits, each feeding two traction motors in series through a group of four single-anode mercury arc rectifiers. These were G.E.C. Com-Pak rectifiers, each nominally rated at 125 A./750 V., of the mercury arc excitron type.

Each rectifier comprised a vacuum-tight metal cylinder hermetically sealed.

It was ignited by a jet of mercury expelled upward through a nozzle. This jet impinged on a small graphite excitation anode in the vicinity of the cathode. This anode was energised with d.c. from an auxiliary excitation rectifier. The arc once struck was maintained independently of the current in the main anode.

The four d.c. traction motors were 200 h.p. class B insulated motors operating in series pairs. They were four-pile machines with interpoles. They had been designed to operate on a rectified supply of 693 V. per motor with a continuously-rated current of 220 A. with full field and 240 A. with weak field. The current from the rectifiers was fed to them through smoothing chokes, which limit the a.c. ripple to 30 per cent.

The tertiary winding on the main transformer supplied power for the auxiliary services, including the battery charger and the auxiliary rectifiers through which the ignition and excitation gear of the main rectifiers was energised. The battery charger consisted of a single-phase transductor-regulated selenium rectifier, from which the d.c. voltage for the 110-V. battery was controlled to close limits.

Nature of the troubles

The results of running up to May 3, 1961, and the troubles experienced are shown in the table which appears below.

The first two columns of the table show the results of trial running on the Colchester-Clacton-Walton lines.

The results of trial running on the North-East London section are shown in col. 3. Here there were 21 rectifier and five battery-charger failures. There were also frequent blowings of fuses on the tertiary circuits, which led to a modification of the transformers. The faults so far experienced were thought to be of a transitory character.

A limited public service on steam timings

FAILURES OF G.E.C. UNITS DURING TRIAL AND SERVICE RUNNING

	Trial running			Service running N.E. London and Colchester-Clacton lines				
	Colchester-Clacton lines		N.E. London lines	Steam timing	Full electric service	Reduced electric service		
	Prototype	Commissioning						
1. Period	Oct. 28, 1959 to July 14, 1960	April 13 to Dec. 28, 1960	May 23 to Nov. 13, 1960	Nov. 14-20, 1960	Nov. 21 to Dec. 11, 1960	Dec. 12, 1960 to Jan. 7, 1961	Jan. 8 to Mar. 16, 1961	Mar. 17 to May 3, 1961
2. Unit miles run ...	25,500	35,800	50,400	36,500	177,000	128,000	290,000	387,000
3. Failures :								
(a) Motors ...	0	0	0	0	19	8	22	7
(b) Rectifiers ...	1	14	21	7	9	15	46	36
(c) Battery chargers ...	1	2	5	2	24	1	4	6
4. Failure rate per 100,000 unit miles:								
(a) Motors ...	0	0	0	0	11	6·2	7·6	1·8
(b) Rectifiers ...	3·9	39	42	19	5·1	12	16	9·3
(c) Battery chargers ...	3·9	5·6	10	5·5	13	0·8	1·4	1·5

was introduced on November 14, and ran for a week with very little trouble.

On November 21, 1960, the full public service was introduced, with 44 G.E.C. units brought into operation. On the first day there were 19 electrical defects, as well as some mechanical failures. The services were seriously disrupted on this and following days, with much inconvenience to passengers. Col. 5 shows that the most serious troubles were the breakdown of traction motors and battery chargers, though rectifier failures continued. Eventually, on December 12, the services were reduced on account of a large number of G.E.C. units being out of action.

The last three columns show the experience during the period of reduced running. In interpreting this experience, the following data are relevant. On December 14, 1960, the first series of modifications, known as the "A" modifications, were agreed on and put in hand. On January 8, 1961, the dividing point between col. 6 and 7, a meeting was held between representation of the British Transport Commission and the contractors, at which Brigadier Langley, Mr. Wheatcroft and Mr. Wilcox were also present. At this meeting, another series of modifications, known as the "B" modifications, were agreed, and plans were made for equipping and running a mobile laboratory in a test train.* By March 16, the dividing point between cols. 7 and 8 of the table, the "B" modifications, had been made on 58 units.

The table shows that, between cols. 5 and 8, the failure rate per 100,000 unit-miles fell from 11 to 1·8 for traction motor and from 13 to 1·5 for battery charges. But the failure rate for rectifiers rose from 5·1 to 9·3.

As a result of meticulous laboratory examinations and analysis, the contractors decided during this period to make major modifications to the rectifiers. These formed part of the "C" modifications which were agreed on as the result of the investigations with the test train.

Main failures

The investigations into the main failures on the G.E.C. units can best be considered under the following headings:—

(*a*) Transformers
(*b*) Traction motors
(*c*) Rectifiers
(*d*) Battery chargers
(*e*) "C" modifications.

(*a*) *Transformers.* Three transformers sustained damage during the period of trial running. In each case the internal connections for the tertiary windings had been seriously distorted, and had touched the side of the transformer tank, thus causing faults to earth, which had blown the tertiary fuses. The screw assemblies supporting the end clamps for the secondary and tertiary windings had also buckled. It was decided to strengthen the clamping arrangements and to stiffen the support of the winding connections.

On April 28, a transformer failure occurred. This and four others were examined by Mr. Lane, and another transformer was subjected to his short-circuit test programme. This last was not conclusive, because of an error in the test plant connections, but examination of the secondary winding revealed signs of movement and some overriding of turns. The failure of the transformer in service had resulted from a breakdown between some of the turns in the secondary winding.

On May 24, a meeting was held between all the interested parties. The contractor agreed that the tap connections must be strengthened, but in his conclusions Brigadier Langley stated that the British Transport Commission proposed to carry out further tests on transformers before deciding whether other modifications were necessary.

(*b*) *Traction Motors.* Following the number of failures during the week of full public service, a series of tests were made by the contractors. These failures had occurred mainly on the Chingford and Enfield lines, where conditions are severe.

A series of modifications, known as the "A" modifications, were agreed. They included the fitting of new surge absorbers across the motor chokes and the checking and adjusting of overload relays.

Main source of trouble

At the meeting on January 8, the contractors' representative explained that, until then, the troubles had been attributed to surges developed in the motor chokes where the original diverters had proved to be inadequate. But the failures since the "A" modifications and further tests suggested that the main source of the trouble lay in transient overvoltages developed by the air-blast circuit-breaker when "chopping" on 6·25 kV. It was believed that these overvoltages created surges in both the secondary and tertiary circuits of sufficient magnitude to cause not only the failures of motors but of the rectifiers and battery chargers.

It was then decided to equip and use the test train. It was also decided to make another series of modifications, known as the "B" modifications, in anticipation of the contractors' theories being proved correct. These modifications included the provision of an earth and an earth fault relay at the mid-point of the motor circuit and the insertion of a 10-k ohm resistor to earth at the mid-point of the transformer secondary. Three surge divertors were also to be fitted at three points in the transformer secondary circuit.

(*c*) *Rectifiers.* Rectifier troubles had persisted throughout, but, until early in December, the contractor did not think that anything was seriously wrong. At the meeting on January 8, it was thought that some of the troubles were associated with transient over-voltages. Further tests were made, but it was difficult to obtain any positive results. Eventually, intensive research traced the trouble to a complex metallurgical condition in parts of the anode which were repeatedly subjected to high thermal stresses which resulted in fatigue failure. A modified form of anode to eliminate failures of this nature was now being incorporated in all the rectifier cylinders. This should stop loss of vacuum.

The test train trials showed that flash-arcs, i.e., backfires, of a duration of less than ½-cycle, often occurred when trains were left standing for long periods with the rectifiers energised but not passing load current. The power circuits were now being modified so that they were physically interrupted when the controller was in the "off" position, thus ensuring that the rectifiers were always disconnected when the equipment was idle.

The contractor considered that flash-arcs, which would momentarily allow current many times full load to pass through the rectifier, were caused by mercury condensation which could be cured by keeping the anode hot. Consequently, the rectifiers were now being given "dual" cooling, whereby the eight anodes were in one cooling circuit and the eight cathodes in the other. This would maintain a suitable temperature differential in the rectifier under all conditions.

The above three changes were part of the "C" modifications. They should go far to eliminate the defects from which these rectifiers had suffered.

With the G.E.C. Com-Pak rectifier, each time voltage was excessively reduced or lost on the excitation circuit, either from arcing or interruption of current at the pantograph, the rectifiers had to be re-ignited. The nature of the excitation gear imposed a limit to the number of re-strikes which could be made in rapid succession. Beyond four or five rapid break/make operations of the air-blast circuit-breaker, the rectifier excitation might "lock out" for a short period and then come back into action after an undetermined time.

Test recovery time

For the rectifiers on the test unit, the recovery time varied between 1 and 8 sec. with individual cylinders. It followed that conditions could arise in which, for a short time, some of the rectifiers were excited and others were unexcited. This might set up "half-wave" conditions—i.e., the normal d.c. current would be changed into a pulsating half-wave current. If during this condition a further tripping of the circuit-breaker occurred with the motor contactors closed, the stored energy in the motor smoothing chokes, which might be considerable, would cause the generation of surge voltages.

During the test runs it was found that loss of contact between the pantograph and the overhead conductor occurred at one or two places on the system ranging from a single interruption up to as many as 14 successive disturbances in a few seconds at speeds of 45 m.p.h., and over.

(*d*) *Battery chargers.* There had been a number of failures here, some resulting from switching surges on the tertiary winding causing over-voltages to be generated within the chargers themselves. It was found that this trouble could be alleviated by fitting resistance capacitor suppressors across the transductors but, as this was not a complete cure, all the transductors were re-wound with very much increased insulation between turns.

Failures had continued, though at a reduced rate. It was now considered that the selenium rectifiers themselves had not always been able to withstand the high transient over-voltages in the tertiary circuits. The "B" and "C" modifications being made would reduce but not eliminate these over-voltages. So the selenium rectifiers would have to be replaced by others with a higher over-voltage margin.

(*e*) "*C*" *Modifications.* These included those made to the rectifiers already described.

During the use of the special test train, 3,000 programmed tests were made as well as numerous records of random incidents leading to over-voltages. A complete analysis of the results would not be available for some time,

*For a description of this train, see *The Railway Gazette*, May 5, 1961

but it could be stated that the tests confirmed that severe over-voltages could be produced by the action of the air-blast circuit-breaker when running on 6·25 kV. with no secondary suppressor fitted to the transformer.

During the tests with the circuit breaker tripping with the main rectifiers operating on half-wave a traction motor failed. This occurred where the earth connections were still at the mid-point of the transformer and without the addition of a protective capacitor. This failure demonstrated dramatically the effect of over-voltage on the motor circuit as originally planned and confirmed the theoretical conclusions.

Mr. Wheatcroft's report

Mr. E. L. E. Wheatcroft, a partner of Messrs. Merz & McLellan, had sent to the British Transport Commission an interim statement of his firm's investigations. Some of the passages from this report are summarised below.

In it, he stated that it was found that the most severe switching over-voltages to which the motors were subjected occurred when the a.c. air-blast circuit-breaker opened during a period in which the normal d.c. motor current had been changed into a pulsating half-wave current by a temporary loss of excitation on some of the rectifiers.

The test results indicated that in the original arrangement, in which the earth was made at the mid-point of the transformer, the motors were subjected to peak over-voltages of more than 10 kV. or greatly in excess of what their insulation can be expected to withstand.

With the earth point at the motors the over-voltages across the motor insulation were negligible, but the over-voltages to earth on the d.c. smoothing chokes and tap changers could be about 10 kV. and 20 kV., respectively. It was expected that the insulation of the smoothing chokes could withstand 10 kV., but that of the tap changer was not adequate to withstand 20 kV.

The method of earthing the motor circuit did not affect the peak over-voltages on the tertiary windings, which were about 2.5 kV. and thus greatly exceeded the safe values for the battery chargers and auxiliary rectifiers.

On the 25-kV. sections of line, the magnitude of the over-voltages encountered on the secondary and tertiary windings of the transformer would be only about one quarter of those encountered on 6·25-kV. sections of line. This was because the peak values of the primary over-voltages were determined by the inherent characteristics of the air-blast circuit-breaker and were approximately the same in both cases, whereas the peak over-voltages, impressed on the secondary and tertiary windings were approximately proportional to the transformation ratios.

Mr. Wheatcroft described the additional over-voltage protective devices already referred to, including the capacitor-resistor unit across the transformer secondary winding. He recommended that the existing auxiliary rectifiers be replaced by others capable of withstanding voltages up to at least 1·2 kV.

He thought that the fundamental cause of the failures of the main mercury arc rectifiers was not yet conclusively established. Investigation, testing, and proving continued. Mr. Wheatcroft added that General Electric Co. Ltd., was confident that, with the modified cooling and re-design of the anodes and other modifications, the rectifier failures would be eliminated, but this could only be proved under service conditions.

Brigadier Langley reported that good progress had been made with the modification of the Glasgow suburban multiple-unit trains. All the new transformer windings had been made and, by May 3 last, 68 transformers had been completed to the new design, referred to in his first interim report.

The modified design of the transformer was type-tested satisfactorily on February 22, and the first reconstructed train, comprising two three-car units, was subjected to oscillographic and other tests.

The enquiry into the reasons for the excess current conditions which caused the collapse of the original transformer secondary windings had necessitated an extensive series of tests. These were continuing, and others were in hand to prove that the modifications which had been introduced would ensure a satisfactory service. Experience with the reconstructed trains had not given rise to any doubts as to the effectiveness of the modifications which had been made.

Inspecting officer's conclusions

Until the end of April, 1961, when a transformer failed in service, the three main causes for the breakdown of the Eastern Region's G.E.C. units had been as follow:—

(*a*) traction motor failures.
(*b*) rectifier break-downs.
(*c*) battery charger failures.

The causes of the troubles were difficult to trace. Those affecting the motors and battery-chargers resulted primarily from transient over-voltages of high magnitude developed by the opening of the air-blast circuit-breaker when trains were operated at 6·25 kV. It was also thought that the main rectifier troubles sprang from the same source, but eventually it was discovered that the cause was mechanical and thermal rather than electrical.

Brigadier Langley accepted Mr. Wheatcroft's conclusions that the design and workmanship of the traction motors was satisfactory and that it had now been definitely established that the motors were damaged by switching over-voltages.

Mr. Wheatcroft had made it clear that the effect of these over-voltages was four times greater when operating on the 6·25-kV. sections than on the 25-kV. sections. This was because the four sections of the transformer secondary winding were connected in series for 25 kV., but in parallel for 6·25 kV. The effect of over-voltages on the secondary winding was transmitted proportionately to the tertiary winding, which was thus subjected to similar heavy surges when the motor units were operating on the lower line voltage.

The deleterious effect of the over-voltages on the traction motors had been practically eliminated by moving the earth connection for the secondary circuit from the mid-point of the transformer winding to the mid-point of the motor bridge circuit. But the result of this had been an increase in the over-voltages to earth through the d.c. smoothing chokes and the transformer secondary tap changers.

Brigadier Langley recommended that consideration be given to re-designing the rectifier excitation gear to increase the number of re-strikes which could be made in rapid succession, and so eliminate the " lock-out " of rectifier excitation which had been the cause of some of the excessive voltage surges.

It had been proved that the most serious over-voltages were generated when the air-blast circuit-breaker opened at a time when the normal d.c. motor current was changed into a pulsating " half-wave " current by the temporary loss of excitation on some of the rectifiers. This phenomenon arose when the loss of contact between the pantograph and the overhead wire (pantograph " bounce ") occurred so frequently that some of the rectifiers were no longer able to re-ignite and " locked-out."

The G.E.C. was fully engaged in applying the agreed modifications. This was not an easy task as it involved alterations to the circuits of 71 traction motor equipments and 71 transformers. It also entailed the reconstruction of nearly 600 mercury arc rectifier cylinders, as well as the provision of the other safeguards already described. The work had to be done piece-meal, and it was unlikely that all the G.E.C. units would be completely modified before the end of the summer.

Investigations had shown that the Eastern Region failures primarily resulted from the onerous conditions set up when running on the 6·25-kV. section of the dual-voltage system. More research was needed, and this should be extended to cover all high-voltage a.c. lines. It should include the running of test trains similar to those on the Eastern Region.

The problems that arose when changing over from one voltage to another required further study. The operation of the circuit-breaker should be examined to see whether the effect of rapid " chopping " could be reduced when operating on 6·25 kV.

The pantograph " bounce "

The causes of pantograph " bounce " also needed further examination. The relationship between the moving pantograph and the overhead wire depended not only on the alignment and level of the wire, but the reaction of the vehicle, influenced in turn by the alignment, level, and cross-level of the track as well as by the vehicle's springing characteristics. Such reactions were accentuated by the speed. All these factors should be considered, and standards laid down to keep this loss of contact between the pantograph and the overhead conductor within reasonable limits.

Attention had been concentrated on establishing the basic causes of the failures which had disrupted some of the a.c. electric services and on effecting permanent cures. Brigadier Langley stated that the main objective had been achieved, and, although no system of railway traction would always be trouble-free, he had every expectation that multiple-unit electric trains would give thoroughly efficient and satisfactory service.

A full report on all the factors affecting these failures and on other relevant matters will be presented later.

WELWYN - HERTFORD SPECIAL

On September 16 the South Bedfordshire Locomotive Club is arranging to run a steam-hauled train over the Welwyn Garden City to Hertford line, normally used for freight traffic only. Tickets are obtainable from Mr. J. F. Crossman, 20 St. Monica's Avenue, Luton, Bedfordshire.

Addition to Channel Islands service

The 4,174-ton *Sarnia*, the British Railways, Southern Region's latest addition to its reorganised Channel Islands service, made her inaugural voyage from Southampton on June 13. This vessel, together with the *Caesarea* put into service last December, and the *St. Patrick* recently refitted, will operate the Weymouth—Channel Islands service which replaces the costly two-port service from both Southampton and Weymouth previously run by the Southern Region.

Sarnia has one-class accommodation for 1,400 passengers, of which 1,200 can be accommodated under cover. She is fitted with a bow rudder so that she can enter ports stern first and, with her sister ship *Caesarea*, is the largest ship which can be handled at St. Helier harbour, Jersey.

The illustration, right, shows the dining accommodation on the *Sarnia*.

The dining saloon on board the Channel Islands ferry "Sarnia"

Questions in Parliament

Euston-Crewe main line

Mr. Kenneth Robinson (St. Pancras N.—Lab.) asked the Minister of Transport on June 14, if he would now state the estimated date of completion of the Euston-Crewe main line electrification.

Mr. Marples, said, in a written answer, that the British Transport Commission estimated that the electrification of this line would be completed by the end of 1966.

Barnsley-Hull railway track

Mr. George Jeger (Goole—Lab.) and Mr. J. M. Coulson (Kingston-upon-Hull—Con.) asked the Minister of Transport on June 14, whether he had yet reached any conclusion from the census of traffic over Boothferry Bridge taken last October, and what action he proposed to take to relieve congestion on this main route between the West Riding and Hull.

Mr. John Hay, Parliamentary Secretary to the Ministry of Transport, said that the conclusion reached from the census is that the advantages of using the abandoned Barnsley-Hull railway track for a new road between Howden and the Great North Road would not be commensurate with the cost, and would offer only limited relief to the route via Boothferry Bridge. In any case, the British Transport Commission had decided to withhold negotiations for disposal of the abandoned track because they might want it for the supply of coal by rail to a new power station to be built in the area.

Staff & Labour Matters

Strike of B.R. motor drivers

The claim of the N.U.R. for one rate (198s. a week) for British Railways motor drivers irrespective of vehicle capacity was declined at a meeting of the Railway Staff Joint Council on June 14.

During the week in which the negotiations took place there were unofficial strikes of motor drivers at a number of depots. The deviation of the stoppages varied from one day to one week, but there was full normal working at all depots on Monday, June 19.

The N.U.R. Executive Committees are now considering the position in the light of the declinature of the claim.

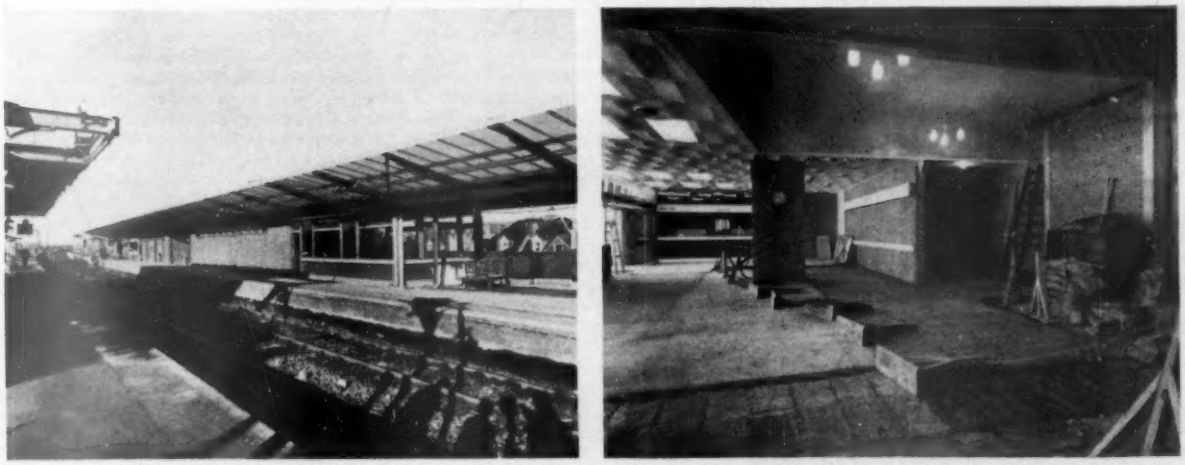
Railway application of disc brakes

British Railways has announced an important new development in railway power brakes. The first freight wagons to go into regular services on any railway using disc brakes and, moreover, using the wheel itself as the disc, are now running in express freight services.

This adaptation of disc braking has been developed under the direction of the Chief Mechanical Engineer of the British Transport Commission's Central Staff, in conjunction with Girling Limited, and is to undergo large-scale trials on 212 coal wagons of three types under service conditions.

The first batch of vehicles equipped with

STATION RECONSTRUCTION IN THE SOUTHERN REGION



Work at Folkestone Central — (left): Down platform (Right): concourse with ticket office in background

disc brakes are 62 21-ton hopper-type coal wagons, which discharge their load through doors in the bottom of the vehicle. These 62 wagons regularly form three express freight trains a week which run at almost passenger-train speed on the Eastern Region's Great Northern Line with bulk loads of coal from Mansfield (Nottingham) to Palace Gates Depot (Wood Green, London). Another 150 wagons, 50 16-ton mineral type, and 100 24½-ton hopper type, are also to be fitted with disc brakes.

The 62 hopper wagons, which were fitted with disc brakes in the railway workshops at Ashford, Kent, were selected for the first large-scale trials because the hopper doors in the bottom of the wagon would interfere with a normal power brake mechanism, whereas the disc brake gear can be mounted clear of the doors.

Brake-gear mounting

The method of mounting the brake gear would also have advantages on other types of wagons as it would simplify the problem of handling wagons in trader's or railway depots by hoists, wagon moving equipment, or tipplers which tip or turn the wagon over to discharge the load. The 16-ton coal wagon is the type of vehicle mostly associated with these operations, and 50 of them are being equipped with disc brakes in British Railways works at York, for trials in general services.

The 100 24½-ton hopper wagons to be built with disc brakes will be used to carry coal to the Central Electricity Generating Board's new power station at Richborough, Kent. They will be run as fast freight trains from the Kent coalfield and must be scheduled between fast passenger train services on the Southern Region's recently electrified Kent Coast line. A power braking system is essential for a fast service of this kind.

The first 20 wagons required for dropping coal at the power station are being built in the railway workshops at Shildon, County Durham. The remaining 80 vehicles to maintain coal supplies will be added to the service by the end of this year.

The adaptation of the disc brake for British railway vehicles is the outcome of several years' research. Practical systems have been devised for both freight wagons and passenger coaches. Some passenger vehicles have also been equipped with disc brakes and have been put in experimental service as part of a series of long-term trials which are still in progress.

North Eastern Region holiday excursions

The North Eastern Region of British Railways is to run series of day trips from Newcastle and Sunderland, Leeds, Bradford and Huddersfield, and Hull and Goole, to different holiday resorts during the summer. Passengers will be able to make a series of day trips returning home each night.

The "Northern Venturer" from Newcastle and Sunderland will run during the period July 31 to August 18, and will make four separate series of trips from Tyneside. One inclusive fare applies to each series. The first outing is on July 31 to Largs, with a cruise to the Isle of Arran. The second on August 2, goes to Bridlington and the third on August 4 goes to Edinburgh, including a motor coach tour. This series will be repeated on August 14, 16, and 18.

During the first week in August the train goes to Scarborough and later Morecambe.

Another series of trips commences on August 8, when the train runs to Callander for a motor coach tour of the Trossachs, returning from Stirling by train, followed by a trip to Whitby on August 10 and on August 11 to Ayr, and a motor coach drive to Culzean Castle.

The "Pennine Rambler" from Leeds, Bradford and Huddersfield will run during the third week of August. The first trip will be on August 14 to Scarborough, on August 16 the train goes to Southport and on August 18 to Llandudno. The inclusive fare for the three trips will be 47s. 6d. from Huddersfield and 50s. from Leeds and Bradford.

The "Humber Rover" will run from Hull and Goole during the second week of August. The train will travel to Windermere Lakeside on August 8 and to Skegness on August 10. The inclusive fare from Hull will be 56s., and from Goole 47s. 9d., children half fare.

C.I.E. development

Coras Iompair Eireann has announced that it will spend £200,000 on a large development and modernisation programme in Limerick during the next year.

The wagon works at Limerick will be reconstructed and modernised to handle all types of wagon repairs and wagon construction work. The station will be reconstructed along the most up-to-date lines.

A road freight depot will be provided and a road freight store will be added to the railway goods store. Bus offices are being built at the station.

The project is scheduled for completion early in 1962. All the work will be done by local labour. The architects are: Mr. G. P. O'Shea, Architect, C.I.E., and Mr. J. Thompson, Architect, Limerick.

Freight terminal for Gateshead

A scheme to provide new and modern railway freight terminal facilities for Tyneside has been approved and construction work on a freight terminal at Gateshead will begin shortly. This was announced recently by British Railways, North Eastern Region, York. The proposal forms an integral part of the Regional plan for concentrating "less-than-wagon-load" freight traffic into fewer but bigger depots.

In what is now the North Eastern Region of British Railways, there were previously nearly a thousand railway freight depots handling smalls traffic. More recently, all this traffic has been concentrated at fewer than a hundred such depots, and now it is planned to reduce these until the whole of the traffic is concentrated in 29, seven of which (including Gateshead) will be concentration centres.

The concentration of Motive Power on the Gateshead (Greensfield) Motive Power Depot, and the construction of the large new marshalling yard at Lamesley, will release the sites of Gateshead (Borough Gardens) Motive Power Depot and the adjacent Gateshead (Park Lane) marshalling yard, and it is here that a freight terminal will be built. The position is at the hub of the Tyneside industrial area, and is also well placed in relation to the Team Valley Trading Estate and the new British Road Services depot at Low Fell.

Incoming traffic

A new single-storey shed for incoming traffic will be provided, 818 ft. long × 170 ft. 6 ins. wide. It will be equipped with two mechanical slat conveyors, each 3 ft. wide, running in parallel the full length of the shed. These will be served at one end by two wagon roads, each holding 14 wagons. At the other end, standage will be provided for 108 road vehicles. Traffic will be discharged from incoming railway wagons and loaded on to the conveyors, on which it will travel to the road vehicles, which in turn will deliver it to the traders' premises. A 30-cwt. gantry crane will deal with heavy and awkward packages. For traffic of a special nature such as tobacco or wines and spirits, a fully-enclosed deck, 235 ft. × 20 ft. served by a wagon road holding 11 wagons will be provided.

Outgoing traffic will be handled in a separate shed, 870 ft. long × 96 ft. 6 in. wide, which will have four lines accommodating 151 wagons, with two paved roadways each 30 ft. wide for road vehicles to bring their loads direct to the wagons and so save intermediate handling. Heavy and awkward consignments will be dealt with by two 20-cwt. electric mobile cranes.

Provision is also to be made at the terminal for traffic in full wagon loads. Seven rail tracks holding 175 wagons, and served by four roadways will be provided, with additional holding sidings. Three mobile cranes varying from 7- to 25-tons capacity will lift heavy traffic.

Ancillary services

Ancillary services include a road-motor repair shop; a 30-ton road weighbridge, provided with a double plate to enable two lines of vehicles to use it at the same time, and a smaller weighbridge inside the shed. New office buildings and modern staff amenities are included in the layout. The scheme also provides for the conversion of the existing goods shed at Gateshead (Eldon Street) to a warehouse to cater for all storage traffic in the Tyneside area. Practically all the traffic in the Warehouse will be "palletised" and moved by two 30-cwt. fork-lift trucks, one 30-cwt. power-pallet truck, and two 30-cwt. manually-operated pallet trucks. A depot for wagon-load traffic, including perishables, is to be laid down in what is at present the shunting neck area of Newcastle Forth Goods Depot. Accommodation will be provided for 230 wagons with road access.

The overall scheme will result in the complete closure of Newcastle New Bridge Street Depot, the major part of the Forth Depot and the closure for "smalls" traffic of nine smaller freight depots in Northumberland and Durham.

The new facilities will serve, within a radius of 15 miles, a population of 1½ million people and in this expanding industrial community will provide a more efficient and greatly improved service to traders and manufacturers. It is expected that the new terminal at Gateshead will be completed in 1963 and the alterations at Gateshead (Eldon Street) and Newcastle (Forth) a few months later.

CONTRACTS AND TENDERS

More diesel locomotives for Sudan Railways

Sudan Railways has ordered a further 10 1,850 h.p. diesel locomotives from the English Electric Co. Ltd., and delivery will commence at the end of the year. In 1959 the company was given an order from the Sudan Railways for 15 similar locomotives to the value of £1·5 million.

In competition with 16 companies from West Germany, Belgium, Italy, and Australia, two Japanese companies have been given an order for electric railway coaches by the United Arab Republic worth £2,900,000.

The Rolls-Royce Railway Traction Department, through Rolls-Royce of Australia, has received an order for 13 horizontal diesel engines, torque converters, reversers, flexible cardan shafts, and controls, from New South Wales Government Railways. The equipment will be used to power seven rail-cars under construction in the N.S.W.G.R. workshops. The order is worth £75,000.

Swedish State Railways has placed a contract for five retarders of the Thyssen W type with Siemens & Halske AG Railway Signalling Factory in Braunschweig. The retarders are for the Hallsberg marshalling yard, the largest and only incline marshalling yard of Sweden. The retarders will be of the semi-automatic type. An extension of the controlling equipment at a later stage to all-automatic operations embodying electronic weight-dependent wagon weighing and hump speed control by means of radar will be provided for.

The Davy & United Engineering Co. Ltd. has been awarded a contract worth more than £1 million for a mechanised plant to produce railway wheels and allied products, by Strojimport of Czechoslovakia. The plant is to be built as an extension to an existing works near Ostrava.

Cowans Sheldon & Co. Ltd. has been given an order for two cranes worth 500,000 dollars. The diesel railway-wrecking cranes are for the newly formed Quebec Cartier Mining Company. The larger crane of 500,000 lb. lifting capacity was designed, built and tested in nine months and dispatched to Canada in November last year. Like the larger, the smaller crane of 300,000 lb. lifting capacity is of diesel-hydraulic design mounted upon a six-axle double-bogie carriage.

British Railways, London Midland Region, has placed the following contracts:

Escay Fencing Contractors Limited, 1961 fencing renewal programme in the Derby North District

J. B. Corrie & Co. Ltd., 1961 fencing renewal programme in the Manchester district

The Pressure Piling Co. (Northern) Ltd., supply of material and manufacture of bored cast-in-place piles for Bridge No. 5, on the Trent-Nottingham line

McCann Limited, provision of low power hot water heating at North Wall, Dublin

J. Rata & Co. Ltd., renewal of retaining wall adjacent to Wolverhampton No. 4 Signalbox alongside the Birmingham Canal

Gilbert Ash Limited, office accommodation for Line Traffic Manager at Crewe.

British Railways, Eastern Region, has placed the following contracts:—

W. & C. French Limited: reconstruction of an abutment of underline bridge No. 1817, between Stonea and March

A. E. Symes Limited: reconstruction of Stanford-le-Hope Station

Hosking & Son (Essex) Ltd.: erection of single-storey ticket office and booking hall building, alterations to air raid shelter on Up platform and provision of new timber framed shelter on Down platform at Benfleet Station

Soil Mechanics Limited: provision of substructure to diesel stores building at Doncaster Locomotive Works

Conder Engineering Co. (Midlands) Ltd.: supply and erection of structural steelwork for stores building at Doncaster Locomotive Works

Thomas Fletcher & Co. Ltd.: construction of subway and formation of embankment at underline bridge No. 258 between Barkston (Goods) and Claypole (Goods)

Walter Cowen Limited: reglazing of roof over parcels roadway at Liverpool Street Station

Bagguley & Barker Limited: works required to provide protection for the north bank of the River Trent under bridge No. 37, between Radcliffe and Netherfield.

Belmont Fencing Co. Ltd.: renewal of fencing alongside running lines in the Sheffield district.

The Export Services Branch, Board of Trade, has received calls for tenders as follow:—

From Chile

9,000 metres multiple-type signalling cable, 3 solid tinned copper conductors, No. 12 a.w.g., 600 V. vulcanised rubber insulated with neoprene lining.

The issuing authority is the Chilean State Railways, Depts. Materiales y Almacenes, Sala de Propuestas, Ier. Piso, Casilla 4742, Correo 2, Santiago de Chile, to which bids should be sent. The tender No. is 21. The closing date is July 25. The Board of Trade reference is ESB/18876/61.

From Ceylon

Supply of 10 5,800 gal. capacity bogie petrol-tank wagons for use on 5 ft. 6 in. gauge after assembly and final painting.

The issuing authority is the Crown Agents for Oversea Governments & Administrations, 4 Millbank, London, S.W.1, who are acting as purchasing agents. The tender No. is 6/EM4 Ceylon Railway 3422. The closing date is August 30. The Board of Trade reference is ESB/188221/61.

From Egypt

Supply and erection of double-swing rail and road bridge over the Suez Canal at El Ferdan and the demolition of the existing bridge.

The issuing authority is Way & Works Department, Egyptian Republic Railways, 2 Midan Ramses, Cairo. The closing date is October 3. The Board of Trade reference is ESB/18821/61. No further information about this call for tenders is available at the Board of Trade.

Supply and erection of railway swing bridge and demolition of existing bridge over the Nile at Benha.

The issuing authority is Way & Works Department, Egyptian Republic Railways, 2 Midan Ramses, Cairo. The closing date is September 9. The Board of Trade reference is ESB/18820/61. No further information about this call for tenders is available at the Board of Trade.

From Greece

Supply, erection, and installation of three water softening units.

The issuing authority is Purchasing & Stores Department, Hellenic State Railways (SEK), 34 Thermistocleosis Street, Athens. The closing date is June 30. The tender No. is 5091. The Board of Trade reference is ESB/19114/61.

From South Africa

Four automatically controlled drainage pumps capable of pumping not less than 30 g.p.m. against head of 20 ft.

The issuing authority is the Chief Stores Superintendent, South African Railways, P.O. Box 8617, Johannesburg, to whom bids should be sent. The tender No. is 89. The closing date is July 5. The Board of Trade reference is E.S.B./20039/61.

One automatic steam generator.

The issuing authority is the Chief Stores Superintendent, South African Railways. P.O. Box 8617, Johannesburg, to whom bids should be sent. The tender No. is F.90. The closing date is July 12. The Board of Trade reference is E.S.B./20040/61.

One crawler tractor, diesel engine 48 h.p.

The issuing authority is the Stores Department, South African Railways, and bids should be sent to the Chairman of the Tender Board, S.A.R., P.O. Box 7784, Johannesburg. The tender No. is F8712. The closing date is July 21. The Board of Trade reference is E.S.B./20041/61.

From Sudan

Three vacuum-operated tractors for turning locomotive turntables.

The issuing authority is the Controller of Stores, Sudan Railways, Atbara, to whom bids should be sent. The tender No. is 2399. The closing date is July 31. The Board of Trade reference is E.S.B./20027/61.

Further details relating to the above tenders together with photo-copies of tender documents, unless otherwise stated, can be obtained from the Branch (Lacon House, Theobald's Road, W.C.1).

NOTES AND NEWS

Steel group headquarters. Steel & Co. Ltd., and its associated companies, have now moved to new headquarters at Steel House, Eastcote, Pinner, Middlesex.

WESTERN REGION PUBLICITY

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A staff recruitment poster issued by the Western Region of British Railways

Evode Group. The London sales office of the Evode Group of Companies has moved to 450/2 Edgware Road, London, W.2.

Change of address. The new address of Crofts (Engineers) Limited London office from June 26 will be 36–42 Tanner Street, Bermondsey, London, S.E.1, telephone number HOP. 7751–4.

Runaway engine. A driverless steam engine ran 3¼ miles along the London-Edinburgh line before being derailed at Doncaster in the Eastern Region of British Railways on June 13. An enquiry into the incident has been ordered.

Brooksby and Frisby Stations to close. The London Midland Region of British Railways has announced that Brooksby and Frisby stations, between Leicester (London Road) and Melton Mowbray (Town), will be closed on and from Monday, July 3. Brooksby will be made an unstaffed goods depot only, and Frisby will be closed to passenger and parcels traffic.

Bedford-Hitchin line withdrawal. The Transport Users' Consultative Committee for London has recommended that a proposal to withdraw the passenger train services on the Bedford-Hitchin line on the London Midland Region of British Railways be approved.

Vandalism in the Scottish Region. The Scottish Region of British Railways has revealed that vandalism in the Glasgow & South West Division is costing £2,000 a week. If attacks on coaches continue there is a possibility that services might be cut through lack of stock.

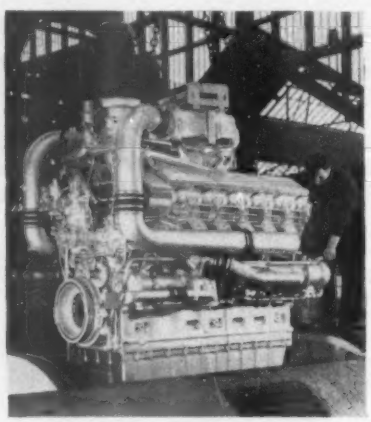
Closing of stations. The London Midland Region of British Railways has announced that Heaton Mersey and Withington & West Didsbury stations, between Manchester (Central) and Cheadle Heath, will be closed on and from Monday, July 3. Heaton Mersey will be used as an unstaffed coal depot only.

Western Region poster. The illustration at the foot of the page shows a new season's poster issued by the Public Relations and Publicity Department of the Western Region of British Railways. The artist is George Leech, R.A. and 2,250 copies of the poster will be displayed by British Railways this summer.

Steel wire for East Germany. The Eastern Region of British Railways ran a special train on June 14 from Doncaster, when British Ropes Limited dispatched part of an order for 600 tons of steel wire to East Germany. The order, which was placed at Leipzig Fair, filled over 60 freight wagons.

Sales area changed. Alcan Industries Limited has announced that, from July 1, its Luton sales office territory will take in Oxfordshire and the southern portions of Buckinghamshire and Essex, hitherto covered by the London sales office.

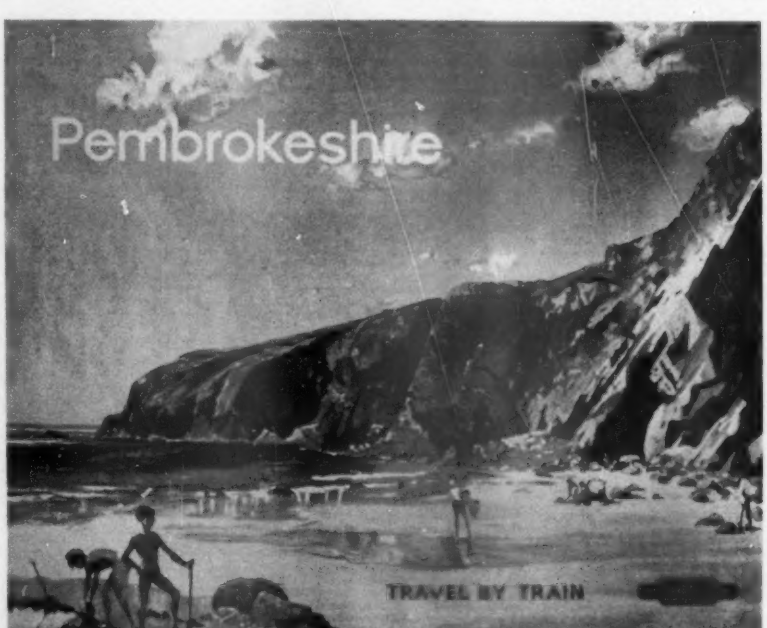
Fitting a diesel engine. The illustration below shows a Bristol Siddeley MD650 12-cylinder high-speed lightweight diesel engine being fitted into a diesel-hydraulic locomotive at the Swindon Works of the Western Region of British Railways. Two of these engines power the locomotives which haul trains such as " The Bristolian " and the " Cornish Riviera Express."



Lightweight diesel engine being lowered into a locomotive at Swindon Works

Investment in Spain. The Tempered Group Limited has acquired an interest in a Spanish company, Muré S.A. of Bilbao, under a recent agreement.

Diesel land cruise. The Scottish Region of British Railways will run a land cruise by special diesel train from Ayr to Dunfermline and Edinburgh via the Forth Bridge. The



Poster by the Public Relations & Publicity Department, Western Region, British Railways

Presentation to mark the arrival of the first electric train at Folkestone

train will leave Ayr at 10 a.m., and time will be allowed at Dunfermline from 12.30–2.30 p.m. and at Edinburgh from 3–5 p.m.

Plastics exhibition. The International Plastics Exhibition & Convention opened at Olympia, London, June 21, and remains open until July 1.

Permanent Way Institution convention. The 1961 summer convention of the Permanent Way Institution was held at Newcastle and Whitley Bay from June 3-8. The itinerary included a visit to the exhibition of railway civil engineering plant at Ponteland on the North Eastern Region of British Railways, the Switch & Crossing Workshops at Gateshead, and the marshalling yard at Lamesley.

London-Folkestone electric service. The first electric multiple-unit train from Charing Cross to Folkestone on June 12 was welcomed at Folkestone by the Mayor, Alderman L. C. Aldridge, who presented the Motorman, Mr. N. Valler and the Stationmaster, Mr. J. Hosmer, with neckties to commemorate the occasion. The illustration above shows the motorman putting on his tie assisted by Mr. Hosmer, and the Mayor of Folkestone.

Tunnel maintenance by air. In previous years the Western Region of British Railways has repaired a concrete " mushroom " in the Bristol Channel by hand. The " mushroom " protects concrete plugs in the strata over the Severn Tunnel and on June 15 fresh concrete was added by helicopter and the repairs completed in one tidal period. The work was under the jurisdiction of Mr. H. G. Lakeman, District Engineer, Bristol, British Railways, Western Region.

Construction equipment exhibition. This international exhibition, which is being held at the Crystal Palace, London, from June 15-24, is claimed to provide the most comprehensive display for the building and civil engineering industries ever assembled. Equipment on display ranges from the smallest hand mechanical-power tools to the largest earth-moving and road-making machinery. Over 170 exhibitors are taking part, and more than 50 companies from overseas are represented.

U.I.C. meeting of Publicity Managers. The Publicity Managers of the West European Railway Administrations held their annual general meeting in London on June 6-7. The Chairman was Mr. M. B. Thomas, Public Relations & Publicity Officer, British Railways, Eastern Region.

Fork-lift truck demonstrations. Hyster materials-handling equipment has been recently demonstrated to engineers from nearly all regions of British Railways. The first was held at the Deptford south-east London premises of Convoys Limited, who use Hyster machines for handling rolls of imported newsprint. The second demonstration was held at Slough, Bucks, and given mainly to British Railways Western Region personnel, where the smaller 4,000-lb. capacity machines were demonstrated. The illustration below shows a demonstration in progress at Slough.

Telex installation. The Birmingham Office of Small & Parkes Limited at 216, Moseley Street, Birmingham, 5, now has a Telex installation. The number is 33570, the back call is DON, Birmingham.

Rail wagons for India. Metropolitan-Cammell Carriage & Wagon Co. Ltd. and Southern Structurals Limited of Madras have agreed to collaborate in the building of wagons in India for the Indian Railways. Under the agreement Metro-Cammell will acquire a substantial shareholding in Southern Structurals.

Railway Queen at Scarborough. The Railway Queen of Britain attended the annual conference of the National Union of Railwaymen's Locomotive & Shed Grades at Scarborough on June 9-10. On her way she visited the Castle Museum at York and met Mr. H. A. Short, General Manager of the North-Eastern Region of British Railways.

1,000th main-line diesel locomotive. The 1,000th main-line diesel locomotive for British Railways, No. D.34, of 2,500 h.p., was completed at Derby railway workshops on June 20. Diesel locomotives are being delivered at the average rate of more than one a day, and already they are used on most main-line passenger trains. Nearly 70 per cent of passenger train mileage on British Railways is now operated by diesel or electric traction.

Day excursions to Belgium. The Eastern Region of British Railways is introducing day excursion facilities to Ostend and Brussels from certain stations in the Sheffield area during the summer months from June 26 to September 7. The outward journey may be made on Mondays, Tuesdays or Wednesdays, returning the following night from

Hyster fork-lift truck being demonstrated to railway officials at Slough

Brussels and Ostend. The second class return fare to Brussels will be 130s. 6d. from Barnsley, 129s. 7d. from Rotherham, 128s. 6d. from Sheffield, and 125s. 9d. from Chesterfield, with reduced fares for children.

Burnley Freight Depot. The London Midland Region of British Railways has announced that electric truck working will be introduced at the modernised freight terminal at Burnley and not a slat conveyor as reported in the article on page 638 of our issue of June 2.

Overseas sales conference. Thomas Smith & Sons (Rodley) Ltd., which manufactures cranes and excavators, held a three-day export sales conference on June 12–14. Delegates from 18 countries attended.

C.N.R. April operating results. Operating revenues of Canadian National Railways for April, 1961, amounted to 54,691,000 dollars. Expenses, taxes, and rents totalled 54,475,000 dollars, resulting in an operating deficiency of 1,784,000 dollars.

Mechanical research laboratory. A mechanical research laboratory was opened at the Heaton works of C. A. Parsons & Co. Ltd., on June 14, by Mr. J. L. Gray, Turbine Plant Design Engineer of the Central Electricity Board.

Machine tool demonstration. Alfred Herbert Limited is arranging a demonstration of up to 100 machine tools at their new premises at 311, Dewsbury Road, Leeds, 11. This demonstration will be held July 4 to 15. Those wishing to attend are asked to give notification by telephoning Leeds 73071-6.

Shareholders missing. The liquidator of the Central Argentine and Buenos Aires & Pacific Railways, Mr. A. S. Matthews, has stated that about 500 shareholders in the companies taken over in 1948 listed in his books are not traceable, and compensation is waiting to be claimed. It is reported that a further share-out of compensation may be announced shortly.

Crowning of Railway Queen. The Railway Employees' Carnival and Crowning of the Railway Queen will be held at Belle Vue, Manchester, on September 9. Mr. D. McKenna, Assistant General Manager, British Railways, Southern Region, and Mr. G. Brassington, Assistant General Secretary, National Union of Railwaymen, have agreed to officiate jointly at the ceremony.

B.E.T. Omnibus Services Limited. The Chairman of B.E.T. Omnibus Services Limited, Mr. John Spencer Wills, speaking at the annual general meeting on June 5, said that even the development of cheap travel by some form of vertical take-off aircraft is likely to affect the motor car and the railways more than the short-distance bus for which he could see no substitute in the foreseeable future.

Aldershot & District Traction Co. Ltd. At the annual general meeting of the Aldershot & District Traction Co. Ltd. on June 9, the Chairman, Mr. T. Robert Williams, said that despite the possibility of losing a few passengers through likely fares increases, by and large many passengers will stay with the company. Many who have previously left to use private transport are returning because of parking difficulties. Public transport had many advantages to offer in this regard.

Canadian Pacific Railway Company. A dividend of 75 cents per share on Canadian Pacific Railway ordinary capital stock, has been declared in respect of 1961.

Railway Stock Market

After a further set-back due to the weakening of the £ in the foreign exchange market, and the widening of the trade gap, stock markets steadied, though uncertainty prevailed partly owing to talk that an increase in the bank rate to 6 per cent may be imminent. It is being widely assumed that Chancellor Selwyn Lloyd will take steps to help strengthen the £ and check inflation dangers, the warning of rising costs throughout industry having been emphasised recently, particularly by the increase in the price of steel which is a sequel to the higher costs of coal and coke carried by the steelmakers. The big talking point is whether the Chancellor will later on also decide to increase purchase tax and excise duties as part of economic regulation policy outlined in the Budget. This included a payroll tax, but it is felt in the City that a very controversial measure such as this is unlikely to be employed.

Foreign rails were scarcely affected by the set-back in stock markets, but many quotations were hardly tested by business. Exceptionally, Antofagasta stocks have been more active, and compared with a week ago, the ordinary stock has moved up from 15¾ to 18, the yield of over 10¾ per cent attracting some attention, while the preferpreference stock, which yields over 14 per cent, gained two points at 33½xd. San Paulo Railway 3s. units held last week's improvement to 2s. and Mexican Central "A" bearer debentures were maintained at 59.

Costa Rica ordinary stock, however, lost a point at 41½, Chilean Northern 5 per cent first debentures were again 50, and Guayaquil & Quito assented bonds changed hands at 55, but Brazil Railway bonds eased from 4 to 3¾. United of Havana second income stock kept at 5¾ and the consolidated stock changed hands at 17s. 6d. Salvador Railway consolidated stock was quoted at 3½.

International of Central America common shares reacted from $18½ to $17½, and the preferred stock from $102½ to $98.

Canadian Pacifics have eased from $47 to $46¾; the 4 per cent preference stock came back from 60½ to 58½, and the 4 per cent debentures from 56 to 55¾. White Pass shares were $11⅞.

Nyasaland Railways shares were again 11s. with the 3½ per cent debentures 32. Midland Railway of Western Australia £1 units of second debentures changed hands at 11s. 3d. West of India Portuguese capital stock was 116½ and Barsi Light Railway stock 17.

Locomotive building, engineering, and kindred shares have been affected by the general set-back in industrial shares, but not a lot of selling was reported, though on the other hand buyers were cautious despite the lower prices. Beyer Peacock 5s. shares moved down to 7s. 9d. compared with 8s. 7½d. a week ago, and Charles Roberts 5s. shares receded from 8s. to 7s., though G. D. Peters were again quoted at 18s. 9d. and Westinghouse Brake have been steady at 43s. 9d.

Elsewhere, however, Birmingham Wagon came back sharply to 26s., a decline of 3s. on balance, and North British Loco. moved from 7s. 3d. to 6s. 6d., while Gloucester Wagon 10s. shares at 9s. 3d. compared with 9s. 10½d. a week ago, and Wagon Repairs 5s. shares reacted from 21s. 9d. to 20s. 6d.

In electricals, A.E.I. came back from 41s. 3d. to 40s. 6d., G.E.C. however, firmed up from 34s. to 34s. 3d. and English Electric at 35s. 3d. were only 3d. easier on balance. B.I.C.C. were 60s. 9d. and Mather & Platt 43s. 9d. Leyland Motors were back to 93s. Pressed Steel 5s. shares to 24s. 3d. and Dowty 10s. shares 35s. 9d.

Vickers at 34s. 7½d., compared with 35s. 9d. a week ago and now yield over 5¾ per cent. Stone-Platt receded 1s. 3d. to 57s. 6d. and Guest Keen fell sharply to 88s. 3d. while T. W. Ward at 79s. 6d. compared with 82s. Babcock & Wilcox fell 1s. 6d. to 30s. 9d. with the general market trend. Steel shares were lower on balance, too, despite the higher steel prices; the general view is that although profits will be lower this year, leading steel companies should be able to maintain their dividends.

Forthcoming Meetings

June 15–24 (*Thu.–Sat.*). International Construction Equipment Exhibition, Crystal Palace, London.

June 26 (*Mon.*). Railway Benevolent Institution, Railway Clearing House, 163 Eversholt Street, N.W.1, at 4 p.m. Annual meeting of members.

June 30–July 3 (*Fri.-Wed.*). Railway Students Association annual convention at Oriel College, Oxford.

July 1 (*Sat.*). The Permanent Way Institution, visit to Plymouth. Joint meeting with Exeter & West of England Section.

July 1 (*Sat.*). The Railway & Canal Historical Society, boat trip on the Staffordshire & Worcestershire Canal.

July 9 (*Sun.*). The Railway Correspondence & Travel Society, Borders scenic rail tour.

July 15 (*Sat.*). The Permanent Way Institution, East Anglia Section. Visit to remodelling of Colchester North Station.

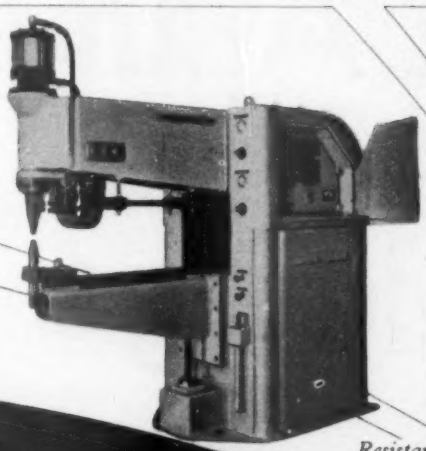
July 16 (*Sun.*). The Stephenson Locomotive Society. Special train to Annesley, Staveley (G.C.), and Mexborough Sheds, and Doncaster Works and Sheds from Birmingham, New Street.

July 16–17 (*Sun.-Mon.*). Railway Canal & Historical Society. 200th Anniversary of opening of Bridgewater Canal.

July 20 (*Thu.*). The Model Railway Club, at Keen House, Calshot Street, N.1, at 7.45 p.m. "R. W. Urie and his Locomotoves," by Mr. T. C. Britten.

July 23 (*Sun.*). The Railway Enthusiasts' Club, North Lincolnshire area tour from Doncaster.

July 29 (*Sat.*). The Permanent Way Institution, London Section. Visit to Colchester Station reconstruction and Harwich Ferry terminus.



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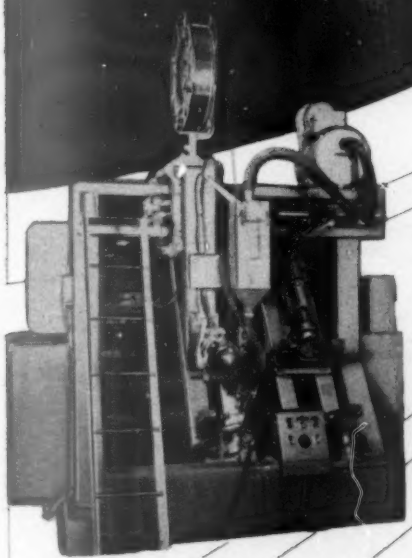

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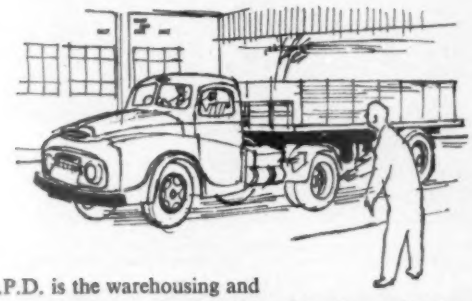

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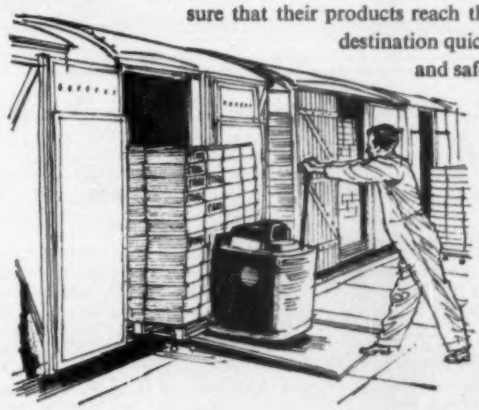

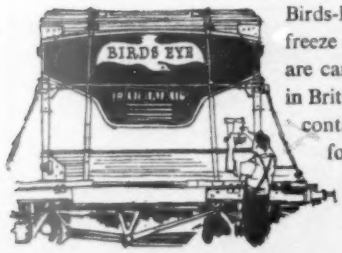

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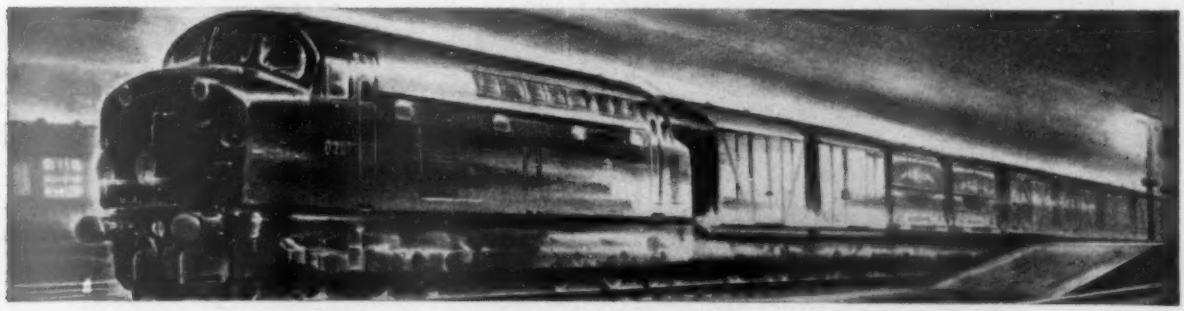

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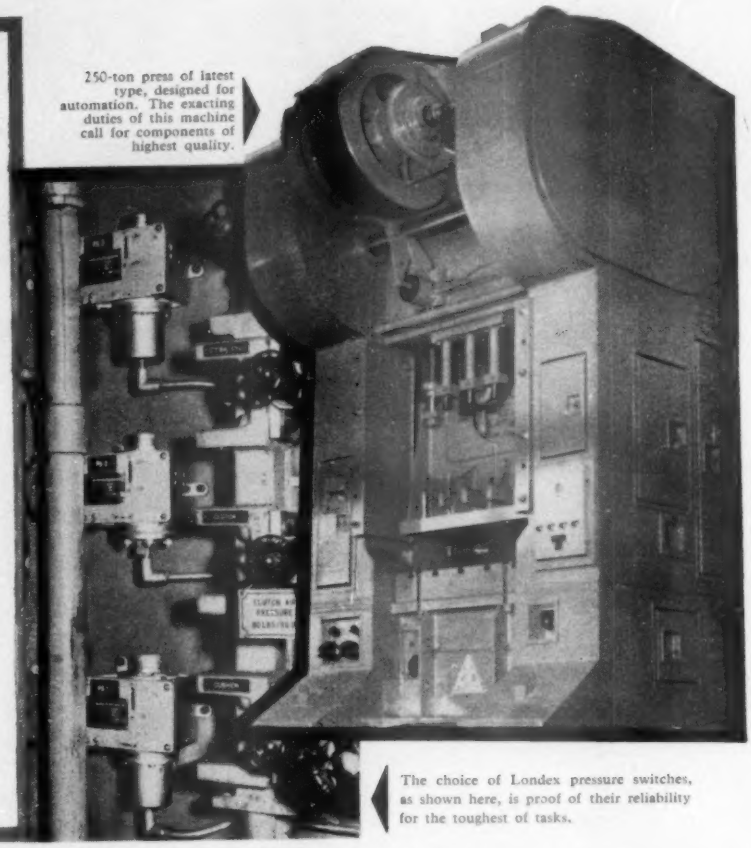

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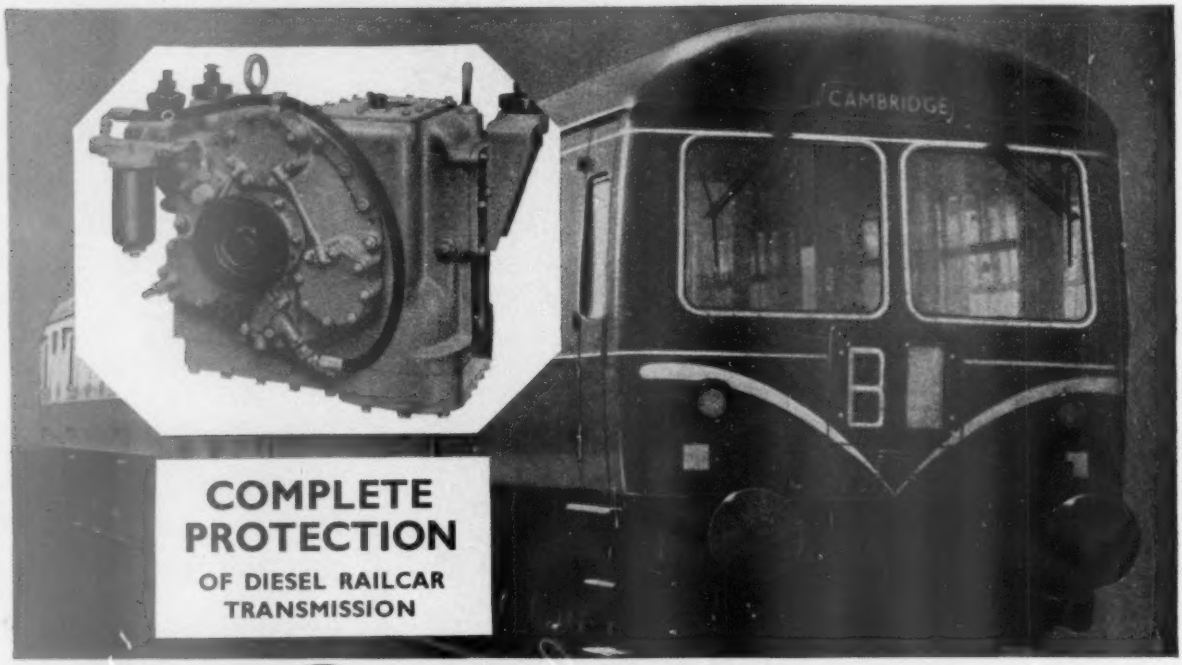

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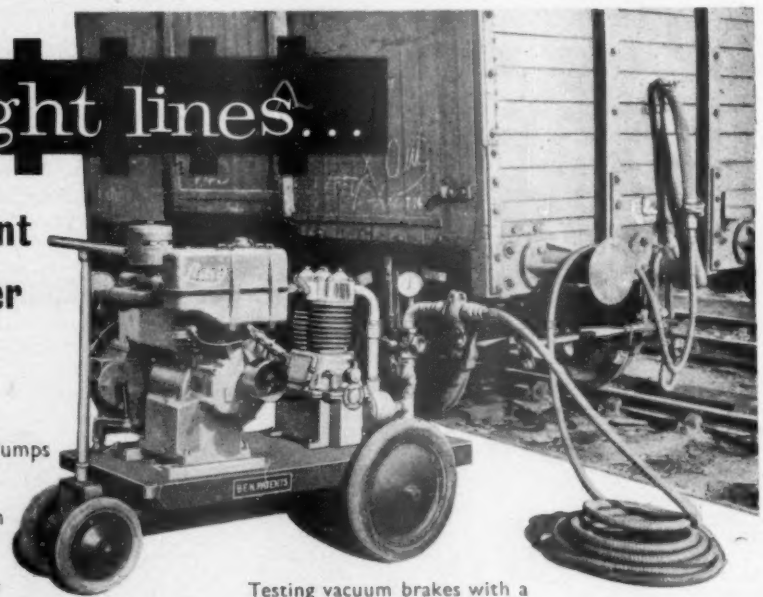

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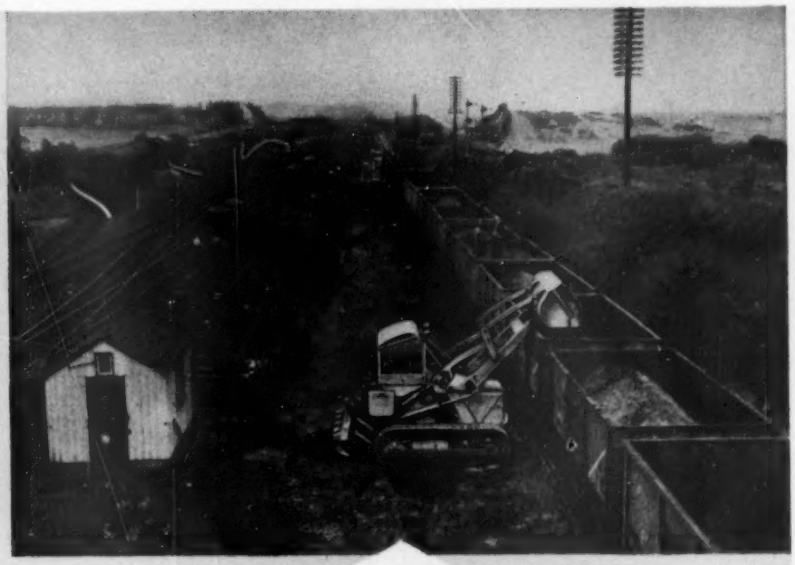
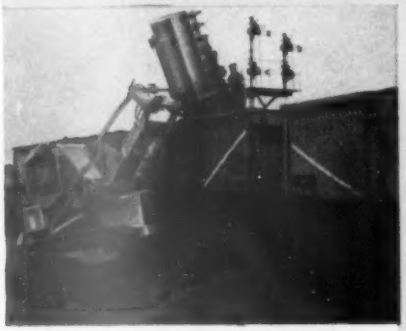
Caterpillar 955 Traxcavator at work on track relaying



Two Caterpillar 955 Traxcavators bulldozing ballast



Side Dump bucket of Caterpillar 955 Traxcavator in operation.

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